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THE

WORKS

OF

GEORGE BERKELEY, D. D.

LATE BISHOP OF CLOYNE IN IRELAND.

TO WHICH IS ADDED,

AN ACCOUNT OF HIS LIFE,

AND

SEVERAL OF HIS LETTERS TO THOMAS PRIOR, ESQ.
DEAN GERVAIS, AND MR. POPE, &c. &c.

IN TWO VOLUMES.

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PASSIVE OBEDIENCE,

OR, THE

CHRISTIAN DOCTRINE

Of NOT RESISTING the SUPREME POWER,

Proved and Vindicated upon the

PRINCIPLES

OF THE

LAW of NATURE.

In a DISCOURSE delivered at the COLLEGE-CHAPEL.

TO THE READER.

THAT an abſolute paſſive obedience ought not to be paid to any civil power: but that ſubmiſſion to government ſhould be meaſured and limited by the public good of the ſociety; and that therefore ſubjects may lawfully reſiſt the ſupreme authority, in thoſe caſes where the public good ſhall plainly ſeem to require it: nay, that it is their duty to do ſo, inaſmuch as they are all under an indiſpenſable obligation to promote the common intereſt: theſe and the like notions, which I cannot help thinking pernicious to mankind and repugnant to *right reaſon*, having of late years been induſtriouſly cultivated, and ſet in the moſt advantageous lights by men of parts and learning, it ſeemed neceſſary to arm the youth of our univerſity againſt them, and take care they go into the world well principled; I do not mean obſtinately prejudiced in favour of a party, but from an early acquaintance with their duty, and the clear rational grounds of it, determined to ſuch practices as may ſpeak them *good chriſtians* and *loyal ſubjects*.

In this view, I made three diſcourſes not many months ſince in the *College-chapel*, which ſome who heard them thought it might be of uſe to make more public: and indeed, the falſe accounts that are gone abroad concerning them, have made it neceſſary. Accordingly I now ſend them into the world under the form of one entire diſcourſe.

To conclude; as in writing theſe thoughts it was my endeavour to preſerve that cool and impartial temper which becomes every ſincere enquirer after truth, ſo I heartily wiſh they may be read with the ſame diſpoſition.

ROMANS, *Chap.* 13. *Ver.* 2.

Whoſoever reſiſteth the Power, reſiſteth the Ordinance of God.

I. IT is not my deſign to enquire into the particular nature of the government and conſtitution of theſe kingdoms; much leſs to pretend to determine concerning the merits of the different parties now reigning in the ſtate. Thoſe topics I profeſs to lie out of my ſphere, and they will probably be thought by moſt men, improper to be treated of in an audience almoſt wholly made up of young perſons, ſet apart from the buſineſs and noiſe of the world, for their more convenient inſtruction in learning and piety. But ſurely it is in no reſpect unſuitable to the circumſtances of this place to inculcate and explain every branch of the law of nature; or thoſe virtues and duties which are equally binding in every kingdom or ſociety of men under heaven; and of this kind I take to be that chriſtian duty of not reſiſting the ſupreme power implied in my text. *Whoſoever reſiſteth the power, reſiſteth the ordinance of God.* In treating on which words I ſhall obſerve the following method.

II. Firſt, I ſhall endeavour to prove, that there is an abſolute unlimited non-reſiſtance or paſſive obedience due to the ſupreme civil power, wherever placed in any nation. Secondly, I ſhall enquire into the grounds and reaſons of the contrary opinion. Thirdly, I ſhall conſider the

the objections drawn from the pretended conſequences of non-reſiſtance to the ſupreme power. In handling theſe points, I intend not to build on the authority of holy ſcripture, but altogether on the principles of reaſon common to all mankind; and that, becauſe there are ſome very rational and learned men, who being verily perſuaded, an abſolute paſſive ſubjection to any earthly power, is repugnant to right reaſon, can never bring themſelves to admit ſuch an interpretation of holy ſcripture (however natural and obvious from the words) as ſhall make that a part of chriſtian religion, which ſeems to them in itſelf manifeſtly abſurd, and deſtructive of the original inherent rights of human nature.

III. I do not mean to treat of that ſubmiſſion, which men are either in duty or prudence obliged to pay inferior or executive powers; neither ſhall I conſider where, or in what perſons the ſupreme or legiſlative power is lodged in this or that government. Only thus much I ſhall take for granted, that there is in every civil community, ſome where or other, placed a ſupreme power of making laws, and enforcing the obſervation of them. The fulfilling of thoſe laws, either by a punctual performance of what is enjoined in them, or, if that be inconſiſtent with reaſon or conſcience, by a patient ſubmiſſion to whatever penalties the ſupreme power hath annexed to the neglect or tranſgreſſion of them, is termed *loyalty*; as on the other hand, the making uſe of force and open violence, either to withſtand the execution of the laws, or ward off the penalties appointed by the ſupreme power, is properly named *rebellion*. Now to make it evident, that every degree of rebellion is criminal in the ſubject; I ſhall in the firſt place endeavour to prove that loyalty is a natural or moral duty; and diſloyalty or rebellion in the moſt ſtrict and proper ſenſe, a vice or breach of the law of nature. And ſecondly, I propoſe to ſhew that the prohibitions of vice, or negative precepts of the law of nature, as, Thou ſhalt not commit adultery, Thou ſhalt not forſwear thyſelf, Thou ſhalt not reſiſt the ſupreme power, and the like,

ought

ought to be taken in a moſt abſolute, neceſſary, and immutable ſenſe: inſomuch, that the attainment of the greateſt good, or deliverance from the greateſt evil, that can befal any man or number of men in this life, may not juſtify the leaſt violation of them. Firſt then I am to ſhew that loyalty is a moral duty, and diſloyalty or rebellion in the moſt ſtrict and proper ſenſe a vice, or breach of the law of nature.

IV. Though it be a point agreed amongſt all wiſe men, that there are certain moral rules or laws of nature, which carry with them an eternal and indiſpenſable obligation; yet concerning the proper methods for diſcovering thoſe laws, and diſtinguiſhing them from others dependent on the humour and diſcretion of men, there are various opinions; ſome direct us to look for them in the divine ideas, others in the natural inſcriptions on the mind; ſome derive them from the authority of learned men, and the univerſal agreement and conſent of nations. Laſtly, others hold that they are only to be diſcovered by the deductions of reaſon. The three firſt methods muſt be acknowledged to labour under great difficulties, and the laſt has not, that I know, been any where diſtinctly explained, or treated of ſo fully as the importance of the ſubject doth deſerve. I hope therefore it will be pardoned, if in a diſcourſe of paſſive obedience, in order to lay the foundation of that duty the deeper, we make ſome enquiry into the origin, nature, and obligation of moral duties in general, and the *criterions* whereby they are to be known.

V. Self-love being a principle of all others the moſt univerſal, and the moſt deeply engraven in our hearts, it is natural for us to regard things, as they are fitted to augment or impair our own happineſs; and accordingly we denominate them *good* or *evil*. Our judgment is ever employed in diſtinguiſhing between theſe two, and it is the whole buſineſs of our lives, to endeavour, by a proper application of our faculties, to procure the

the one and avoid the other. At our firſt coming into the world, we are entirely guided by the impreſſions of ſenſe, ſenſible pleaſure being the infallible characteriſtic of preſent good, as pain is of evil. But by degrees, as we grow up in our acquaintance with the nature of things, experience informs us that preſent good is afterwards oft attended with a greater evil; and on the other ſide, that preſent evil is not leſs frequently the occaſion of procuring to us a greater future good. Beſides, as the nobler faculties of the human ſoul begin to diſplay themſelves, they diſcover to us goods far more excellent than thoſe which affect the ſenſes. Hence an alteration is wrought in our judgments, we no longer comply with the firſt ſolicitations of ſenſe, but ſtay to conſider the remote conſequences of an action, what good may be hoped, or what evil feared from it, according to the wonted courſe of things. This obliges us frequently to overlook preſent momentary enjoyments, when they come in competition with greater and more laſting goods, though too far off, or of too refined a nature to affect our ſenſes.

VI. But as the whole earth, and the entire duration of thoſe periſhing things contained in it, is altogether inconſiderable, or in the prophet's expreſſive ſtile, *leſs than nothing* in reſpect of eternity, who ſees not that every reaſonable man ought ſo to frame his actions, as that they may moſt effectually contribute to promote his eternal intereſt? And ſince it is a truth evident by the light of nature, that there is a ſovereign omniſcient ſpirit, who alone can make us for ever happy, or for ever miſerable: it plainly follows, that a conformity to his will, and not any proſpect of temporal advantage, is the ſole rule whereby every man who acts up to the principles of reaſon, muſt govern and ſquare his actions. The ſame concluſion doth likewiſe evidently reſult from the relation which God bears to his creatures. God alone is maker and preſerver of all things. He is therefore with the moſt undoubted right the great legiſla-

tor

tor of the world; and mankind are by all the ties of duty, no leſs than intereſt, bound to obey his laws.

VII. Hence we ſhould above all things endeavour to trace out the divine will, or the general deſign of Providence with regard to mankind, and the methods moſt directly tending to the accompliſhment of that deſign, and this ſeems the genuine and proper way for diſcovering the laws of nature. For laws being rules directive of our actions to the end intended by the legiſlator, in order to attain the knowledge of God's laws, we ought firſt to enquire what that end is, which he deſigns ſhould be carried on by human actions. Now, as God is a being of infinite goodneſs, it is plain the end he propoſes is *good*. But God enjoying in himſelf all poſſible perfection, it follows that it is not his own good, but that of his creatures. Again, the moral actions of men are entirely terminated within themſelves, ſo as to have no influence on the other orders of intelligences or reaſonable creatures: the end therefore to be procured by them, can be no other than the good of men. But as nothing in a natural ſtate can entitle one man more than another to the favour of God, except only moral goodneſs, which conſiſting in a conformity to the laws of God, doth preſuppoſe the being of ſuch laws, and law ever ſuppoſing an end, to which it guides our actions, it follows that antecedent to the end propoſed by God, no diſtinction can be conceived between men; that end therefore itſelf or general deſign of Providence is not determined or limited by any reſpect of perſons: it is not therefore the private good of this or that man, nation or age, but the general well-being of all men, of all nations, of all ages of the world, which God deſigns ſhould be procured by the concurring actions of each individual. Having thus diſcovered the great end, to which all moral obligations are ſubordinate; it remains, that we enquire what methods are neceſſary for the obtaining that end.

VIII. The well-being of mankind muſt neceſſarily be carried on one of theſe two ways: either firſt, without the injunction of any certain univerſal rules of morality, only by obliging every one upon each particular occaſion, to conſult the public good, and always to do that, which to him ſhall ſeem in the preſent time and circumſtances, moſt to conduce to it. Or ſecondly, by enjoining the obſervation of ſome determinate, eſtabliſhed laws, which, if univerſally practiſed, have from the nature of things an eſſential fitneſs to procure the well-being of mankind; though in their particular application, they are ſometimes through untoward accidents, and the perverſe irregularity of human wills, the occaſions of great ſufferings, and misfortunes, it may be, to very many good men. Againſt the former of theſe methods there lie ſeveral ſtrong objections. For brevity I ſhall mention only two.

IX. Firſt, it will thence follow, that the beſt men for want of judgment, and the wiſeſt for want of knowing all the hidden circumſtances and conſequences of an action, may very often be at a loſs how to behave themſelves; which they would not be, in caſe they judged of each action, by comparing it with ſome particular precept, rather than by examining the good or evil which in that ſingle inſtance it tends to procure: it being far more eaſy to judge with certainty, whether ſuch or ſuch an action be a tranſgreſſion of this or that precept, than whether it will be attended with more good or ill conſequences. In ſhort, to calculate the events of each particular action is impoſſible, and though it were not, would yet take up too much time to be of uſe in the affairs of life. Secondly, if that method be obſerved, it will follow that we can have no ſure ſtandard, to which comparing the actions of another, we may pronounce them good or bad, virtues or vices. For ſince the meaſure and rule of every good man's actions is ſuppoſed to be nothing elſe, but his own private diſintereſted opinion, of what makes moſt for the public good at that juncture: and ſince this opinion muſt unavoidably

bly in different men, from their particular views and circumſtances, be very different: it is impoſſible to know, whether any one inſtance of parricide or perjury, for example, be criminal. The man may have had his reaſons for it, and that which in me would have been a heinous ſin, may be in him a duty. Every man's particular rule is buried in his own breaſt, inviſible to all but himſelf, who therefore can only tell whether he obſerves it or no. And ſince that rule is fitted to particular occaſions, it muſt ever change as they do: hence it is not only various in different men, but in one and the ſame man at different times.

X. From all which it follows, there can be no harmony or agreement between the actions of good men: no apparent ſteadineſs or conſiſtency of one man with himſelf, no adhering to principles: the beſt actions may be condemned, and the moſt villanous meet with applauſe. In a word, there enſues the moſt horrible confuſion of vice and virtue, ſin and duty, that can poſſibly be imagined. It follows therefore that the great end, to which God requires the concurrence of human actions, muſt of neceſſity be carried on by the ſecond method propoſed, namely, the obſervation of certain, univerſal, determinate rules or moral precepts, which, in their own nature, have a neceſſary tendency to promote the well-being of the ſum of mankind, taking in all nations and ages, from the beginning to the end of the world.

XI. Hence upon an equal comprehenſive ſurvey of the general nature, the paſſions, intereſts, and mutual reſpects of mankind; whatſoever practical propoſition doth to right reaſon evidently appear to have a neceſſary connexion with the univerſal well-being included in it, is to be looked upon as enjoined by the will of God. For he that willeth the end, doth will the neceſſary means conducive to that end; but it hath been ſhewn, that God willeth the univerſal well-being of mankind ſhould be promoted by the concurrence of each particular perſon; therefore

every ſuch practical propoſition, neceſſarily tending thereto, is to be eſteemed a decree of God, and is conſequently a law to man.

XII. Theſe propoſitions are called *laws of nature*, becauſe they are univerſal, and do not derive their obligation from any civil ſanction, but immediately from the author of nature himſelf. They are ſaid to be *ſtamped on the mind*, to be *engraven on the tables of the heart*, becauſe they are well known to mankind, and ſuggeſted and inculcated by conſcience. Laſtly, they are termed *eternal rules of reaſon*, becauſe they neceſſarily reſult from the nature of things, and may be demonſtrated by the infallible deductions of reaſon.

XIII. And notwithſtanding that theſe rules are too often, either by the unhappy concurrence of events, or more eſpecially by the wickedneſs of perverſe men, who will not conform to them, made accidental cauſes of miſery to thoſe good men, who do; yet this doth not vacate their obligation, they are ever to be eſteemed the fixed unalterable ſtandards of moral good and evil; no private intereſt, no love of friends, no regard to the public good, ſhould make us depart from them. Hence when any doubt ariſes concerning the morality of an action, it is plain, this cannot be determined by computing the public good, which in that particular caſe it is attended with, but only by comparing it with the eternal law of reaſon. He who ſquares his actions by this rule, can never do amiſs, though thereby he ſhould bring himſelf to poverty, death, or diſgrace: no, not though he ſhould involve his family, his friends, his country in all thoſe evils, which are accounted the greateſt, and moſt inſupportable to human nature. Tenderneſs and benevolence of temper are often motives to the beſt and greateſt actions; but we muſt not make them the ſole rule of our actions; they are paſſions rooted in our nature, and like all other paſſions muſt be reſtrained and kept under, other-

otherwiſe they may poſſibly betray us into as great enormities, as any other unbridled luſt. Nay, they are more dangerous than other paſſions, inſomuch as they are more plauſible, and apt to dazzle, and corrupt the mind, with the appearance of goodneſs and generoſity.

XIV. For the illuſtration of what has been ſaid, it will not be amiſs, if from the moral we turn our eyes on the natural world. *Homo ortus eſt* (ſays *Balbus* in *Cicero**) *ad mundum contemplandum, & imitandum:* and ſurely, it is not poſſible for free intellectual agents to propoſe a nobler pattern for their imitation than nature, which is nothing elſe but a ſeries of free actions produced by the beſt and wiſeſt agent. But it is evident that thoſe actions are not adapted to particular views, but all conformed to certain general rules, which being collected from obſervation, are by philoſophers termed laws of nature. And theſe indeed are excellently ſuited to promote the general well-being of the creation: but what from caſual combinations of events, and what from the voluntary motions of animals, it often falls out, that the natural good not only of private men, but of entire cities and nations, would be better promoted by a particular ſuſpenſion, or contradiction, than an exact obſervation of thoſe laws. Yet for all that, nature ſtill takes its courſe; nay, it is plain that plagues, famines, inundations, earthquakes, with an infinite variety of pains and ſorrows; in a word, all kinds of calamities public and private do ariſe from a uniform ſteady obſervation of thoſe general laws, which are once eſtabliſhed by the author of nature, and which he will not change or deviate from upon any of thoſe accounts, how wiſe or benevolent ſoever it may be thought by fooliſh men to do ſo. As for the miracles recorded in ſcripture, they were always wrought for confirmation of ſome doctrine or miſſion from God, and not for the ſake of the particular natural goods, as health or life, which ſome men might have reaped from them. From all which it ſeems

* *De Natura Deorum*, Lib. 2.

ſufficiently

ſufficiently plain, that we cannot be at a loſs, which way to determine, in caſe we think God's own methods the propereſt to obtain his ends, and that it is our duty to copy after them, ſo far as the frailty of our nature will permit.

XV. Thus far in general, of the nature and neceſſity of moral rules, and the *criterion* or mark whereby they may be known. As for the particulars, from the foregoing diſcourſe, the principal of them may without much difficulty be deduced. It hath been ſhewn that the law of nature is a ſyſtem of ſuch rules or precepts, as that if they be all of them, at all times, in all places, and by all men obſerved, they will neceſſarily promote the well-being of mankind, ſo far as it is attainable by human actions. Now, let any one who hath the uſe of reaſon, take but an impartial ſurvey of the general frame and circumſtances of human nature, and it will appear plainly to him, that the conſtant obſervation of truth, for inſtance, of juſtice, and chaſtity, hath a neceſſary connexion with their univerſal well-being; that therefore they are to be eſteemed virtues or duties, and that, *thou ſhalt not forſwear thyſelf*, *thou ſhalt not commit adultery*, *thou ſhalt not ſteal*, are ſo many unalterable moral rules, which to violate in the leaſt degree is vice or ſin. I ſay, the agreement of theſe particular practical propoſitions, with the definition, or *criterion* premiſed, doth ſo clearly reſult from the nature of things, that it were a needleſs digreſſion, in this place to enlarge upon it. And from the ſame principle, by the very ſame reaſoning, it follows that loyalty is a moral virtue, and, *thou ſhalt not reſiſt the ſupreme power*, a rule or law of nature, the leaſt breach whereof hath the inherent ſtain of moral turpitude.

XVI. The miſeries inſeparable from a ſtate of anarchy are eaſily imagined. So inſufficient is the wit or ſtrength of any ſingle man, either to avert the evils, or procure the bleſſings of life, and ſo apt are the wills

wills of different perſons to contradict and thwart each other, that it is abſolutely neceſſary, ſeveral independent powers be combined together, under the direction (if I may ſo ſpeak) of one and the ſame will, I mean the law of the ſociety. Without this there is no politeneſs, no order, no peace among men, but the world is one great heap of miſery and confuſion; the ſtrong as well as the weak, the wiſe as well as the fooliſh, ſtanding on all ſides expoſed to all thoſe calamities, which man can be liable to in a ſtate where he has no other ſecurity, than the not being poſſeſſed of any thing which may raiſe envy or deſire in another. A ſtate! by ſo much more ineligible than that of brutes, as a reaſonable creature hath a greater reflexion and foreſight of miſeries than they. From all which it plainly follows, that loyalty or ſubmiſſion to the ſupreme authority, hath, if univerſally practiſed in conjunction with all other virtues, a neceſſary connexion with the well-being of the whole ſum of mankind; and by conſequence, if the *criterion* we have laid down, be true, it is, ſtrictly ſpeaking, a moral duty, or branch of natural religion. And therefore, the leaſt degree of rebellion is with the utmoſt ſtrictneſs and propriety, a *ſin:* not only in chriſtians, but alſo in thoſe who have the light of reaſon alone for their guide. Nay, upon a thorough and impartial view, this ſubmiſſion will, I think, appear one of the very firſt and fundamental laws of nature, inaſmuch as it is civil government which ordains and marks out the various relations between men, and regulates property, thereby giving ſcope and laying a foundation for the exerciſe of all other duties. And in truth, whoever conſiders the condition of man, will ſcarce conceive it poſſible that the practice of any one moral virtue ſhould obtain, in the naked, forlorn ſtate of nature.

XVII. But ſince it muſt be confeſſed, that in all caſes our actions come not within the direction of certain fixed moral rules, it may poſſibly be ſtill queſtioned, whether obedience to the ſupreme power be not one of thoſe

thoſe exempted caſes, and conſequently to be regulated by the prudence and diſcretion of every ſingle perſon, rather than adjuſted to the rule of abſolute non-reſiſtance. I ſhall therefore endeavour to make it yet more plain, that, *thou ſhalt not reſiſt the ſupreme power*, is an undoubted precept of morality; as will appear from the following conſiderations. Firſt then, ſubmiſſion to government is a point *important* enough to be eſtabliſhed by a moral rule. Things of inſignificant and trifling concern, are, for that very reaſon, exempted from the rules of morality. But government, on which ſo much depend the peace, order, and well-being of mankind, cannot ſurely be thought of too ſmall importance to be ſecured and guarded by a moral rule. Government, I ſay, which is itſelf the principal ſource under heaven, of thoſe particular advantages, for the procurement and conſervation whereof, ſeveral unqueſtionable moral rules were preſcribed to men.

XVIII. Secondly, obedience to government is a caſe *univerſal* enough to fall under the direction of a law of nature. Numberleſs rules there may be for regulating affairs of great concernment, at certain junctures, and to ſome particular perſons or ſocieties, which notwithſtanding are not to be eſteemed moral or natural laws, but may be either totally abrogated or diſpenſed with; becauſe the private ends they were intended to promote, reſpect only ſome particular perſons, as engaged in relations not founded in the general nature of man, who on various occaſions, and in different poſtures of things, may proſecute their own deſigns by different meaſures, as in human prudence ſhall ſeem convenient. But what relation is there more extenſive and univerſal than that of ſubject and law? This is confined to no particular age or climate, but univerſally obtains at all times, and in all places, wherever men live in a ſtate exalted above that of brutes. It is therefore evident, that the rule forbidding reſiſtance to the law or ſupreme power, is not upon pretence of any defect

defect in point of *univerſality*, to be excluded from the number of the laws of nature.

XIX. Thirdly, there is another conſideration, which confirms the neceſſity of admitting this rule for a moral or natural law; namely, becauſe the caſe it regards is of too *nice* and *difficult* a nature to be left to the judgment and determination of each private perſon. Some caſes there are ſo plain and obvious to judge of, that they may ſafely be truſted to the prudence of every reaſonable man; but in all inſtances, to determine, whether a civil law is fitted to promote the public intereſt; or whether ſubmiſſion or reſiſtance will prove moſt advantageous in the conſequence; or when it is, that the general good of a nation may require an alteration of government, either in its form, or in the hands which adminiſter it: theſe are points too arduous and intricate, and which require too great a degree of parts, leiſure, and liberal education, as well as diſintereſtedneſs and thorough knowledge in the particular ſtate of a kingdom, for every ſubject to take upon him the determination of them. From which it follows, that upon this account alſo, non-reſiſtance, which, in the main, no body can deny to be a moſt profitable and wholſome duty, ought not to be limited by the judgment of private perſons to particular occaſions, but eſteemed a moſt ſacred law of nature.

XX. The foregoing arguments do, I think, make it manifeſt, that the precept againſt rebellion is on a level with other moral rules. Which will yet farther appear from this fourth and laſt conſideration. It cannot be denied, that right reaſon doth require ſome common ſtated rule or meaſure, whereby ſubjects ought to ſhape their ſubmiſſion to the ſupreme power; ſince any claſhing or diſagreement in this point muſt unavoidably tend to weaken, and diſſolve the ſociety. And it is unavoidble, that there ſhould be great claſhing, where it is left to the breaſt of

each individual to ſuit his fancy with a different meaſure of obedience. But this common ſtated meaſure muſt be either the general precept forbidding reſiſtance, or elſe the public good of the whole nation: which laſt, though it is allowed to be in itſelf ſomething certain and determinate; yet, foraſmuch as men can regulate their conduct only by what appears to them, whether in truth it be what it appears or no; and ſince the proſpects men form to themſelves of a country's public good, are commonly as various as its landſcapes, which meet the eye in ſeveral ſituations: it clearly follows, that to make the public good the rule of obedience, is in effect, not to eſtabliſh any determinate, agreed, common meaſure of loyalty, but to leave every ſubject to the guidance of his own particular mutable fancy.

XXI. From all which arguments and conſiderations it is a moſt evident concluſion, that the law prohibiting rebellion is in ſtrict truth a law of nature, univerſal reaſon, and morality. But to this, it will perhaps be objected by ſome, that whatever may be concluded with regard to reſiſtance, from the tedious deductions of reaſon, yet there is I know not what turpitude and deformity in ſome actions, which at firſt bluſh ſhews them to be vicious; but they, not finding themſelves ſtruck with ſuch a ſenſible and immediate horror at the thought of rebellion, cannot think it on a level with other crimes againſt nature. To which I anſwer, that it is true, there are certain natural antipathies implanted in the ſoul, which are ever the moſt laſting and inſurmountable; but as cuſtom is a ſecond nature, whatever averſions are from our early childhood continually infuſed into the mind, give it ſo deep a ſtain as is ſcarce to be diſtinguiſhed from natural complexion. And as it doth hence follow, that to make all the inward horrors of ſoul paſs for infallible marks of ſin, were the way to eſtabliſh error and ſuperſtition in the world: ſo, on the other hand, to ſuppoſe all actions lawful, which are unattended with thoſe ſtarts of nature, would prove of the laſt dangerous conſequence to virtue

virtue and morality. For theſe pertaining to us as men, we muſt not be directed in reſpect of them by any emotions in our blood and ſpirits, but by the dictates of ſober and impartial reaſon. And if there be any, who find they have a leſs abhorrence of rebellion than of other villanies, all that can be inferred from it, is, that this part of their duty was not ſo much reflected on, or ſo early and frequently inculcated into their hearts, as it ought to have been. Since without queſtion there are other men who have as thorough an averſion for that, as for any other crime *.

XXII. Again, it will probably be objected, that ſubmiſſion to government differs from moral duties, in that it is founded in a contract, which upon the violation of its conditions doth of courſe become void, and in ſuch caſe rebellion is lawful: it hath not therefore the nature of a ſin or crime, which is in itſelf abſolutely unlawful, and muſt be committed on no pretext whatſoever. Now, paſſing over all enquiry and diſpute concerning the firſt obſcure riſe of government, I obſerve its being founded on a contract may be underſtood in a twofold ſenſe, either, firſt, that ſeveral independent perſons finding the unſufferable inconvenience of a ſtate of anarchy, where every one was governed by his own will, conſented and agreed together to pay an abſolute ſubmiſſion, to the decrees of ſome certain legiſlative; which, though ſometimes they may bear hard on the ſubject, yet muſt ſurely prove eaſier to be governed by, than the violent humours and unſteady oppoſite wills of a multitude of ſavages. And in caſe we admit ſuch a compact to have been the original founda-

* *Il diſoit ordinairement qu'il avoit un auſſi grand eloignement pour ce peché là que pour aſſaſſiner le monde, ou pour voler ſur les grands chemins, & qu'enfin il ny avoit rien qui fut plus contraire à ſon naturel.* He (*Mr. Paſcal*) uſed to ſay he had as great an abhorrence of rebellion as of murder, or robbing on the highway, and that there was nothing more ſhocking to his nature. *Vie de Mr. Paſcal*, page 44.

tion of civil government, it muſt even on that ſuppoſition be held ſacred and inviolable.

XXIII. Or ſecondly, it is meant that ſubjects have contracted with their reſpective ſovereigns or legiſlators, to pay, not an abſolute, but conditional and limited ſubmiſſion to their laws, that is, upon condition, and ſo far forth, as the obſervation of them ſhall contribute to the public good: reſerving ſtill to themſelves a right of ſuperintending the laws, and judging whether they are fitted to promote the public good or no; and (in caſe they or any of them think it needful) of reſiſting the higher powers, and changing the whole frame of government by force: which is a right that all mankind, whether ſingle perſons or ſocieties, have over thoſe that are deputed by them. But in this ſenſe a contract cannot be admitted for the ground and meaſure of civil obedience, except one of theſe two things be clearly ſhewn: either, firſt, that ſuch a contract is an expreſs known part of the fundamental conſtitution of a nation, equally allowed and unqueſtioned by all as the common law of the land: or, ſecondly, if it be not expreſs, that it is at leaſt neceſſarily implied in the very nature or notion of civil polity, which ſuppoſes it is a thing manifeſtly abſurd, that a number of men ſhould be obliged to live under an unlimited ſubjection to civil law, rather than continue wild and independent of each other. But to me it ſeems moſt evident, that neither of thoſe points will ever be proved.

XXIV. And till they are proved beyond all contradiction, the doctrine built upon them, ought to be rejected with deteſtation. Since to repreſent the higher powers as deputies of the people, manifeſtly tends to diminiſh that awe and reverence, which all good men ſhould have for the laws and government of their country. And to ſpeak of a conditioned, limited loyalty, and I know not what vague and undetermined contracts, is a moſt effectual means to looſen the bands of civil ſociety; than

than which nothing can be of more miſchievous conſequence to mankind. But after all, if there be any man, who either cannot or will not ſee the abſurdity and perniciouſneſs of thoſe notions, he would, I doubt not, be convinced with a witneſs, in caſe they ſhould once become current, and every private man take it in his head to believe them true, and put them in practice.

XXV. But there ſtill remains an objection, which hath the appearance of ſome ſtrength againſt what has been ſaid. Namely, that whereas civil polity is a thing entirely of human inſtitution, it ſeems contrary to reaſon, to make ſubmiſſion to it part of the law of nature, and not rather of the civil law. For how can it be imagined that nature ſhould dictate or preſcribe a natural law about a thing, which depends on the arbitrary humour of men, not only as to its kind or form, which is very various and mutable, but even as to its exiſtence; there being no where to be found a civil government ſet up by nature. In anſwer to this, I obſerve firſt, that moſt moral precepts do preſuppoſe ſome voluntary actions, or pacts of men, and are nevertheleſs eſteemed laws of nature. Property is aſſigned, the ſignification of words aſcertained, and matrimony contracted by the agreement and conſent of mankind; and for all that it is not doubted, whether theft, falſehood, and adultery be prohibited by the law of nature. Loyalty, therefore, though it ſhould ſuppoſe and be the reſult of human Inſtitutions, may, for all that, be of natural obligation. I ſay, ſecondly, that, notwithſtanding particular ſocieties are formed by men, and are not in all places alike, as things eſteemed natural are wont to be, yet there is implanted in mankind a natural tendency or diſpoſition to a ſocial life. I call it *natural*, becauſe it is univerſal, and becauſe it neceſſarily reſults from the differences which diſtinguiſh man from beaſt: the peculiar wants, appetites, faculties, and capacities of man, being exactly calculated, and framed for ſuch a ſtate, inſomuch that without it, it is impoſſible he ſhould live in a condition in any degree

ſuitable

ſuitable to his nature. And ſince the bond and cement of ſociety is a ſubmiſſion to its laws, it plainly follows, that this duty hath an equal right with any other to be thought a law of nature. And ſurely that precept which enjoins obedience to civil laws, cannot itſelf with any propriety be accounted a civil law: it muſt therefore either have no obligation at all on the conſcience, or if it hath, it muſt be derived from the univerſal voice of nature and reaſon.

XXVI. And thus the firſt point propoſed ſeems clearly made out: namely, that loyalty is a virtue or moral duty; and diſloyalty or rebellion, in the moſt ſtrict and proper ſenſe, a vice or crime againſt the law of nature. We are now come to the ſecond point, which was to ſhew, that the prohibitions of vice, or negative precepts of morality, are to be taken in a moſt abſolute, neceſſary, and immutable ſenſe; inſomuch that the attainment of the greateſt good, or deliverance from the greateſt evil; that can befal any man or number of men in this life, may not juſtify the leaſt violation of them. But in the firſt place, I ſhall explain the reaſon of diſtinguiſhing between poſitive and negative precepts, the latter only being included in this general propoſition. Now the ground of that diſtinction may be reſolved into this; namely, that very often, either through the difficulty or number of moral actions, or their inconſiſtence with each other, it is not poſſible for one man to perform ſeveral of them at the ſame time; whereas it is plainly conſiſtent and poſſible, that any man ſhould, at the ſame time, abſtain from all manner of poſitive actions whatſoever. Hence it comes to paſs, that prohibitions or negative precepts muſt by every one, in all times and places, be all actually obſerved: whereas thoſe which enjoin the doing of an action, allow room for human prudence and diſcretion, in the execution of them: it for the moſt part depending on various accidental circumſtances; all which ought to be conſidered, and care taken that duties of leſs moment do not interfere with, and hinder the fulfilling of thoſe which are more important.

And

And for this reaſon, if not the poſitive laws themſelves, at leaſt the exerciſe of them admits of ſuſpenſion, limitation, and diverſity of degrees. As to the indiſpenſableneſs of the negative precepts of the law of nature, I ſhall in its proof offer two arguments; the firſt from the nature of the thing, and the ſecond from the imitation of God in his government of the world.

XXVII. Firſt then, from the nature of the thing, it hath been already ſhewn, that the great end of morality can never be carried on, by leaving each particular perſon to promote the public good, in ſuch a manner as he ſhall think moſt convenient, without preſcribing certain determinate, univerſal rules to be the common meaſure of moral actions: and, if we allow the neceſſity of theſe, and at the ſame time think it lawful to tranſgreſs them, whenever the public good ſhall ſeem to require it, what is this, but in words indeed to enjoin the obſervation of moral rules, but in effect to leave every one to be guided by his own judgment? than which nothing can be imagined more pernicious and deſtructive to mankind, as hath been already proved. Secondly, this ſame point may be collected from the example ſet us by the author of nature, who, as we have above obſerved, acts according to certain fixed laws, which he will not trangreſs upon the account of accidental evils ariſing from them. Suppoſe a prince, on whoſe life the welfare of a kingdom depends, to fall down a precipice, we have no reaſon to think, that the univerſal law of gravitation would be ſuſpended in that caſe. The like may be ſaid of all other laws of nature, which we do not find to admit of exceptions on particular accounts.

XXVIII. And, as without ſuch a ſteadineſs in nature, we ſhould ſoon, inſtead of this beautiful frame, ſee nothing but a diſorderly, and confuſed chaos: ſo if once it become current, that the moral actions of men are not to be guided by certain definite inviolable rules, there will be no longer

longer found that beauty, order, and agreement, in the ſyſtem of rational beings, or moral world, which will then be all covered over with darkneſs and violence. It is true, he who ſtands cloſe to a palace, can hardly make a right judgment of the architecture and ſymmetry of its ſeveral parts, the nearer ever appearing diſproportionably great. And if we have a mind to take a fair proſpect of the order and general well-being, which the inflexible laws of nature and morality derive on the world, we muſt, if I may ſo ſay, go out of it, and imagine ourſelves to be diſtant ſpectators of all that is tranſacted and contained in it; otherwiſe we are ſure to be deceived by the too near view of the little preſent intereſts of ourſelves, our friends, or our country. The right underſtanding of what hath been ſaid will, I think, afford a clear ſolution to the following difficulties.

XXIX. Firſt, it may perhaps ſeem to ſome, that in conſequence of the foregoing doctrine, men will be left to their own private judgments as much as ever. For, firſt, the very being of the laws of nature; ſecondly, the *criterion* whereby to know them; and, thirdly, the agreement of any particular precept with that *criterion*, are all to be diſcovered by reaſon and argumentation, in which every man doth neceſſarily judge for himſelf: hence upon that ſuppoſition, there is place for as great confuſion, unſteadineſs, and contrariety of opinions and actions, as upon any other. I anſwer, that however men may differ, as to what were moſt proper and beneficial to the public to be done or omitted on particular occaſions, when they have for the moſt part narrow and intereſted views; yet in general concluſions, drawn from an equal and enlarged view of things, it is not poſſible there ſhould be ſo great, if any, diſagreement at all amongſt candid, rational enquirers after truth.

XXX. Secondly, the moſt plauſible pretence of all againſt the doctrine we have premiſed concerning a rigid indiſpenſable obſervation of moral

moral rules, is that which is founded on the conſideration of the public weal: for ſince the common good of mankind is confeſſedly the end which God requires ſhould be promoted by the free actions of men, it may ſeem to follow, that all good men ought ever to have this in view, as the great mark to which all their endeavours ſhould be directed; if therefore in any particular caſe, a ſtrict keeping to the moral rule ſhall prove manifeſtly inconſiſtent with the public good, it may be thought agreeable to the will of God, that in that caſe the rule does reſtrain an honeſt diſintereſted perſon, from acting for that end to which the rule itſelf was ordained. For it is an axiom, that *the end is more excellent than the means*, which deriving their goodneſs from the end, may not come in competition with it.

XXXI. In anſwer to this, let it be obſerved, that nothing is a *law* merely becauſe it conduceth to the public good, but becauſe it is decreed by the will of God, which alone can give the ſanction of a *law of nature* to any precept: neither is any thing, how expedient or plauſible ſoever, to be eſteemed lawful on any other account, than its being coincident with, or not repugnant to, the laws promulgated by the voice of nature and reaſon. It muſt indeed be allowed, that the rational deduction of thoſe laws is founded in the intrinſic tendency they have to promote the well-being of mankind, on condition they are univerſally and conſtantly obſerved. But though it afterwards comes to paſs, that they accidentally fail of that end, or even promote the contrary, they are nevertheleſs binding, as hath been already proved. In ſhort, that whole difficulty may be reſolved by the following diſtinction. In framing the general laws of nature, it is granted, we muſt be entirely guided by the public good of mankind, but not in the ordinary moral actions of our lives. Such a rule, if univerſally obſerved, hath from the nature of things, a neceſſary fitneſs to promote the general well-being of mankind: therefore it is a law of nature. This is good reaſoning. But if we ſhould ſay, ſuch an action

doth in this inſtance produce much good, and no harm to mankind; therefore it is lawful: this were wrong. The rule is framed with reſpect to the good of mankind; but our practice muſt be always ſhaped immediately by the rule. They who think the public good of a nation to be the ſole meaſure of the obedience due to the civil power, ſeem not to have conſidered this diſtinction.

XXXII. If it be ſaid that ſome negative precepts, *e. g. thou ſhalt not kill*, do admit of limitation, ſince otherwiſe it were unlawful for the magiſtrate, for a ſoldier in a battle, or a man in his own defence, to kill another: I anſwer, when a duty is expreſſed in too general terms, as in this inſtance, in order to a diſtinct declaration of it, either thoſe terms may be changed for others of a more limited ſenſe, as *kill* for *murder*, or elſe from the general propoſition remaining in its full latitude, exceptions may be made of thoſe preciſe caſes, which not agreeing with the notion of murder, are not prohibited by the law of nature. In the former caſe there is a limitation, but it is only of the ſignification of a ſingle term too general and improper, by ſubſtituting another more proper and particular in its place. In the latter caſe there are exceptions, but then they are not from the law of nature, but from a more general propoſition, which beſides that law, includes ſomewhat more, which muſt be taken away in order to leave the law by itſelf clear and determinate. From neither of which conceſſions will it follow, that any negative law of nature is limited to thoſe caſes only where its particular application promotes the public good, or admits all other caſes to be excepted from it, wherein its being actually obſerved produceth harm to the public. But of this I ſhall have occaſion to ſay more in the ſequel. I have now done with the firſt head, which was to ſhew, that there is an abſolute, unlimited paſſive obedience due to the ſupreme power, whereever placed in any nation; and come to enquire into the grounds

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and reaſons of the contrary opinion: which was the ſecond thing propoſed.

XXXIII. One great principle, which the pleaders for reſiſtance make the ground-work of their doctrine, is, that the law of ſelf-preſervation is *prior* to all other engagements, being the very firſt and fundamental law of nature. Hence, ſay they, ſubjects are obliged by nature, and it is their duty, to reſiſt the cruel attempts of tyrants, however authorized by unjuſt and bloody laws, which are nothing elſe but the decrees of men, and conſequently muſt give way to thoſe of God or nature. But perhaps, if we narrowly examine this notion, it will not be found ſo juſt and clear as ſome men may imagine, or, indeed, as at firſt ſight it ſeems to be. For we ought to diſtinguiſh between a two-fold ſignification of the terms *law of nature*; which words do either denote a rule or precept for the direction of the voluntary actions of reaſonable agents, and in that ſenſe they imply a duty; or elſe they are uſed to ſignify any general rule, which we obſerve to obtain in the works of nature, independent of the wills of men; in which ſenſe no duty is implied. And in this laſt acceptation, I grant it is a general law of nature, that in every animal there be implanted a deſire of ſelf-preſervation, which, though it is the earlieſt, the deepeſt, and moſt laſting of all, whether natural or acquired appetites, yet cannot with any propriety be termed a moral duty. But if in the former ſenſe of the words, they mean that ſelf-preſervation is the firſt and moſt fundamental law of nature, which therefore muſt take place of all other natural or moral duties: I think that aſſertion to be manifeſtly falſe, for this plain reaſon, becauſe it would thence follow, a man may lawfully commit any ſin whatſoever to preſerve his life, than which nothing can be more abſurd.

XXXIV. It cannot indeed be denied, that the law of nature reſtrains us from doing thoſe things which may injure the life of any man, and

conſequently our own. But, notwithſtanding all that is ſaid of the obligativeneſs and priority of the law of ſelf-preſervation, yet, for ought I can ſee, there is no particular law, which obliges any man to prefer his own temporal good, not even life itſelf, to that of another man, much leſs to the obſervation of any one moral duty. This is what we are too ready to perform of our own accord; and there is more need of a law to curb and reſtrain, than there is of one to excite and inflame our ſelf-love.

XXXV. But, ſecondly, though we ſhould grant the duty of ſelf-preſervation to be the firſt and moſt neceſſary of all the poſitive or affirmative laws of nature; yet, foraſmuch as it is a maxim allowed by all moraliſts, that *evil is never to be committed, to the end good may come of it*, it will thence plainly follow, that no negative precept ought to be tranſgreſſed for the ſake of obſerving a poſitive one; and therefore, ſince we have ſhewn, *thou ſhalt not reſiſt the ſupreme power*, to be a negative law of nature, it is a neceſſary conſequence, that it may not be tranſgreſſed under pretence of fulfilling the poſitive duty of ſelf-preſervation.

XXXVI. A ſecond erroneous ground of our adverſaries, whereon they lay a main ſtreſs, is that they hold the public good of a particular nation to be the meaſure of the obedience due from the ſubject to the civil power, which therefore may be reſiſted whenſoever the public good ſhall verily ſeem to require it. But this point hath been already conſidered, and in truth it can give ſmall difficulty to whoever underſtands loyalty to be on the ſame foot with other moral duties enjoined in negative precepts, all which though equally calculated to promote the general well-being, may not nevertheleſs be limited or ſuſpended under pretext of giving way to the end, as is plain from what hath been premiſed on that ſubject.

XXXVII.

XXXVII. A third reaſon which they inſiſt on, is to this effect. All civil authority or right is derived originally from the people; but no body can transfer that to another, which he hath not himſelf; therefore, ſince no man hath an abſolute unlimited right over his own life, the ſubject cannot transfer ſuch a right to the prince (or ſupreme power) who conſequently hath no ſuch unlimited right to diſpoſe of the lives of his ſubjects. In caſe therefore a ſubject reſiſt his prince, who acting according to law, maketh an unjuſt, though legal, attempt on his life, he does him no wrong; ſince wrong it is not, to prevent another from ſeizing what he hath no right to: whence it ſhould ſeem to follow, that agreeably to reaſon, the prince, or ſupreme power whereſoever placed, may be reſiſted. Having thus endeavoured to ſtate their argument in its cleareſt light, I make this anſwer. Firſt, it is granted, no civil power hath an unlimited right to diſpoſe of the life of any man. Secondly, in caſe one man reſiſt another invading that which he hath no right to, it is granted he doth him no wrong. But in the third place, I deny that it doth thence follow, the ſupreme power may conſonantly to reaſon be reſiſted; becauſe that although ſuch reſiſtance wronged not the prince or ſupreme power whereſoever placed, yet it were injurious to the author of nature, and a violation of his law, which reaſon obligeth us to tranſgreſs upon no account whatſoever, as hath been demonſtrated.

XXXVIII. A fourth miſtake or prejudice which influenceth the impugners of non-reſiſtance, ariſes from the natural dread of ſlavery, chains, and fetters which inſpires them with an averſion for any thing, which even metaphorically comes under thoſe denominations. Hence they cry out againſt us that we would deprive them of their natural freedom, that we are making chains for mankind, that we are for enſlaving them, and the like. But how harſh ſoever the ſentence may appear, yet it is moſt true, that our appetites, even the moſt natural, as of eaſe, plenty, or life itſelf, muſt be chained and fettered by the laws of nature and reaſon.

reaſon. This ſlavery, if they will call it ſo, or ſubjection of our paſſions to the immutable decrees of reaſon, though it may be galling to the ſenſual part or the beaſt, yet ſure I am, it addeth much to the dignity of that which is peculiarly human in our compoſition. This leads me to the fifth fundamental error.

XXXIX. Namely, the miſtaking the object of paſſive obedience. We ſhould conſider, that when a ſubject endures the inſolence and oppreſſion of one or more magiſtrates, armed with the ſupreme civil power, the object of his ſubmiſſion is, in ſtrict truth, nothing elſe but right reaſon, which is the voice of the author of nature. Think not we are ſo ſenſeleſs, as to imagine tyrants caſt in a better mould than other men: no, they are the worſt and vileſt of men, and for their own ſakes have not the leaſt right to our obedience. But the laws of God and nature muſt be obeyed, and our obedience to them is never more acceptable and ſincere, than when it expoſeth us to temporal calamities.

XL. A ſixth falſe ground of perſuaſion to thoſe we argue againſt, is their not diſtinguiſhing between the natures of poſitive and negative duties. For, ſay they, ſince our active obedience to the ſupreme civil power is acknowledged to be limited, why may not our duty of non-reſiſtance be thought ſo too? The anſwer is plain; becauſe poſitive and negative moral precepts are not of the ſame nature, the former admitting ſuch limitations and exceptions as the latter are on no account liable to, as hath been already proved. It is very poſſible that a man in obeying the commands of his lawful governors, might tranſgreſs ſome law of God contrary to them; which it is not poſſible for him to do, merely by a patient ſuffering and non-reſiſtance for conſcience ſake. And this furniſhes ſuch a ſatisfactory and obvious ſolution of the forementioned difficulty, that I am not a little ſurprized to ſee it inſiſted on, by men, otherwiſe, of good ſenſe and reaſon. And ſo much for the grounds and

reaſons

reaſons of the adverſaries of non-reſiſtance. I now proceed to the third and laſt thing propoſed, namely, the conſideration of the objections drawn from the pretended conſequences of non-reſiſtance.

XLI. Firſt then it will be objected, that in conſequence of that notion, we muſt believe that God hath, in ſeveral inſtances, laid the innocent part of mankind under an unavoidable neceſſity of enduring the greateſt ſufferings and hardſhips without any remedy; which is plainly inconſiſtent with the divine wiſdom and goodneſs: and therefore the principle from whence that conſequence flows, ought not to be admitted as a law of God or nature. In anſwer to which I obſerve, we muſt carefully diſtinguiſh between the neceſſary and accidental conſequences of a moral law. The former kind are thoſe which the law is in its own nature calculated to produce, and which have an inſeparable connexion with the obſervation of it; and indeed if theſe are bad, we may juſtly conclude the law to be ſo too, and conſequently not from God. But the accidental conſequences of a law have no intrinſic natural connexion with, nor do they ſtrictly ſpeaking flow from its obſervation, but are the genuine reſult of ſomething foreign and circumſtantial, which happens to be joined with it. And theſe accidental conſequences of a very good law may nevertheleſs be very bad; which badneſs of theirs is to be charged on their own proper and neceſſary cauſe, and not on the law, which hath no eſſential tendency to produce them. Now though it muſt be granted, that a lawgiver infinitely wiſe and good will conſtitute ſuch laws for the regulation of human actions, as have in their own nature a neceſſary inherent aptneſs to promote the common good of all mankind, and that in the greateſt degree that the preſent circumſtances and capacities of human nature will admit; yet we deny that the wiſdom and goodneſs of the lawgiver are concerned, or may be called in queſtion, on account of the particular evils which ariſe, neceſſarily and properly, from the *tranſgreſſion* of ſome one or more good laws, and but accidentally from

from the *obſervation* of others. But it is plain that the ſeveral calamities and devaſtations, which oppreſſive governments bring on the world, are not the genuine neceſſary effects of the law, that enjoineth a paſſive ſubjection to the ſupreme power, neither are they included in the primary intention thereof, but ſpring from avarice, ambition, cruelty, revenge, and the like inordinate affections and vices raging in the breaſts of governors. They may not therefore argue a defect of wiſdom or goodneſs in God's law, but of righteouſneſs in men.

XLII. Such is the preſent ſtate of things, ſo irregular are the wills, and ſo unreſtrained the paſſions of men, that we every day ſee manifeſt breaches and violations of the laws of nature, which being always committed in favour of the wicked, muſt ſurely be ſometimes attended with heavy diſadvantages and miſeries, on the part of thoſe who by a firm adheſion to his laws endeavour to approve themſelves in the eyes of their Creator. There are in ſhort, no rules of morality, not excepting the beſt, but what may ſubject good men to great ſufferings and hardſhips, which neceſſarily follows from the wickedneſs of thoſe they have to deal with, and but accidentally from thoſe good rules. And as on the one hand it were inconſiſtent with the wiſdom of God, by ſuffering a retaliation of fraud, perjury, or the like on the head of offenders, to puniſh one tranſgreſſion by another: ſo on the other hand, it were inconſiſtent with his juſtice, to leave the good and innocent a hopeleſs ſacrifice to the wicked. God therefore hath appointed a day of retribution in another life, and in this we have his grace and a good conſcience for our ſupport. We ſhould not therefore repine at the divine laws, or ſhew a frowardneſs or impatience of thoſe tranſient ſufferings they accidentally expoſe us to, which however grating to fleſh and blood, will yet ſeem of ſmall moment, if we compare the littleneſs and fleetingneſs of this preſent world with the glory and eternity of the next.

XLIII.

XLIII. From what hath been ſaid I think it is plain, that the premiſed doctrine of non-reſiſtance were ſafe, though the evils incurred thereby ſhould be allowed never ſo great. But perhaps upon a ſtrict examination, they will be found much leſs than by many they are thought to be. The miſchievous effects which are charged on that doctrine may be reduced to theſe two points. Firſt, that it is an encouragement for all governors to become tyrants, by the proſpect it gives them of impunity or non-reſiſtance. Secondly, that it renders the oppreſſion and cruelty of thoſe who are tyrants, more inſupportable and violent, by cutting off all oppoſition, and conſequently all means of redreſs. I ſhall conſider each of theſe diſtinctly. As to the firſt point, either you'll ſuppoſe the governors to be good or ill men. If they are good, there is no fear of their becoming tyrants. And if they are ill men, that is, ſuch as poſtpone the obſervation of God's laws to the ſatisfying of their own luſts, then it can be no ſecurity to them, that others will rigidly obſerve thoſe moral precepts, which they find themſelves ſo prone to trangreſs.

XLIV. It is indeed a breach of the law of nature for a ſubject, though under the greateſt and moſt unjuſt ſufferings, to lift up his hand againſt the ſupreme power. But it is a more heinous and inexcuſable violation of it, for the perſons inveſted with the ſupreme power, to uſe that power to the ruin and deſtruction of the people committed to their charge. What encouragement therefore can any man have to think that others will not be puſhed on by the ſtrong implanted appetite of ſelf-preſervation, to commit a crime, when he himſelf commits a more brutiſh and unnatural crime, perhaps without any provocation at all? Or is it to be imagined that they who daily break God's laws, for the ſake of ſome little profit or tranſient pleaſure, will not be tempted by the love of property, liberty, or life itſelf, to tranſgreſs that ſingle precept which forbids reſiſtance to the ſupreme power?

XLV. But it will be demanded, to what purpoſe then is this duty of non-reſiſtance preached and proved, and recommended to our practice, if in all likelihood, when things come to an extremity, men will never obſerve it? I anſwer, to the very ſame purpoſe that any other duty is preached. For what duty is there which many, too many, upon ſome conſideration or other may not be prevailed on to tranſgreſs? Moraliſts and divines do not preach the duties of nature and religion, with the view of gaining mankind to a perfect obſervation of them; that they know is not to be done. But, however, our pains are anſwered, if we can make men leſs ſinners than otherwiſe they would be; if by oppoſing the force of duty to that of preſent intereſt and paſſion, we can get the better of ſome temptations, and balance others, while the greateſt ſtill remain invincible.

XLVI. But granting thoſe who are inveſted with the ſupreme power to have all imaginable ſecurity, that no cruel and barbarous treatment whatever could provoke their ſubjects to rebellion: yet I believe it may be juſtly queſtioned, whether ſuch ſecurity would tempt them to more or greater acts of cruelty, than jealouſy, diſtruſt, ſuſpicion and revenge may do in a ſtate leſs ſecure. And ſo far in conſideration of the firſt point, namely, that the doctrine of non-reſiſtance is an encouragement for governors to become tyrants.

XLVII. The ſecond miſchievous effect it was charged with, is, that it renders the oppreſſion and cruelty of thoſe who are tyrants more inſupportable and violent, by cutting off all oppoſition, and conſequently all means of redreſs. But, if things are rightly conſidered, it will appear, that redreſſing the evils of government by force, is at beſt, a very hazardous attempt, and what often puts the public in a worſe ſtate than it was before. For either you ſuppoſe the power of the rebels to be but ſmall, and eaſily cruſhed, and then this is apt to inſpire the governors with

with confidence and cruelty. Or, in caſe you ſuppoſe it more conſiderable, ſo as to be a match for the ſupreme power ſupported by the public treaſure, forts and armies, and that the whole nation is engaged in a civil war; the certain effects of this are rapine, bloodſhed, miſery, and confuſion to all orders and parties of men, greater and more inſupportable by far, than are known under any the moſt abſolute and ſevere tyranny upon earth. And it may be that after much mutual ſlaughter, the rebellious party will prevail. And if they do prevail to deſtroy the government in being, it may be they will ſubſtitute a better in its place, or change it into better hands. And may not this come to paſs without the expence, and toil, and blood of war? Is not the heart of a prince in the hand of God? may he not therefore give him a right ſenſe of his duty, or may he not call him out of the world by ſickneſs, accident, or the hand of ſome deſperate ruffian, and ſend a better in his ſtead? When I ſpeak as of a monarchy, I would be underſtood to mean all ſorts of government, whereſoever the ſupreme power is lodged. Upon the whole, I think we may cloſe with the heathen philoſopher, who thought it the part of a wiſe man, never to attempt the change of government by force, when it could not be mended without the ſlaughter and baniſhment of his countrymen: but to ſit ſtill, and pray for better times *. For this way may do, and the other may not do; there is uncertainty in both courſes. The difference is, that in the way of rebellion, we are ſure to increaſe the public calamities, for a time at leaſt, though we are not ſure of leſſening them for the future.

XLVIII. But though it ſhould be acknowledged, that in the main, ſubmiſſion and patience ought to be recommended; yet, men will be ſtill apt to demand, whether extraordinary caſes may not require extraordinary meaſures; and therefore in caſe the oppreſſion be inſupportable, and the proſpect of deliverance ſure, whether rebellion may not be allowed

* Plato *in Epiſt.* 7.

of? I anſwer, by no means. Perjury, or breach of faith, may, in ſome poſſible caſes, bring great advantage to a nation, by freeing it from conditions inconſiſtent with its liberty and public welfare. So likewiſe, may adultery, by procuring a domeſtic heir, prevent a kingdom's falling into the hands of a foreign power, which would in all probability prove its ruin. Yet will any man ſay, the extraordinary nature of thoſe caſes can take away the guilt of perjury and adultery? * This is what I will not ſuppoſe. But it hath been ſhewn, that rebellion is as truly a crime againſt nature and reaſon as either of the foregoing, it may not therefore be juſtified upon any account whatever, any more than they.

XLIX. What! muſt we then ſubmit our necks to the ſword? and is there no help, no refuge againſt extreme tyranny eſtabliſhed by law? In anſwer to this, I ſay in the firſt place, it is not to be feared that men in their wits ſhould ſeek the deſtruction of their people, by ſuch cruel and unnatural decrees as ſome are forward to ſuppoſe. I ſay, ſecondly, that in caſe they ſhould, yet moſt certainly the ſubordinate magiſtrates may

* When I wrote this, I could not think any man would avow the juſtifying thoſe crimes on any pretext: but I ſince find that an author (ſuppoſed the ſame who publiſhed the book entitled, *The Rights of the Chriſtian Church*) in a diſcourſe concerning obedience to the ſupreme powers, printed with three other diſcourſes at *London*, in the year 1709, chap. 4. p. 28. ſpeaking of divine laws, is not aſhamed to aſſert, *there is no law which wholly relates to man, but ceaſes to oblige, if upon the infinite variety of circumſtances attending human affairs, it happens to be contrary to the good of man.* So that, according to this writer, parricide, inceſt, or breach of faith, become innocent things, if, in the infinite variety of circumſtances, they ſhould happen to promote (or be thought by any private perſon to promote) the public good. After what has been already ſaid, I hope I need not be at any pains to convince the reader of the abſurdity and perniciouſneſs of this notion. I ſhall only obſerve, that it appears the author was led into it, by a more than ordinary averſion to paſſive obedience, which put him upon meaſuring or limiting that duty, and, with equal reaſon, all others, by the public good, to the entire unhinging of all order and morality among men. And it muſt be owned the tranſition was very natural.

not,

not, nay, they ought not, in obedience to thoſe decrees to act any thing contrary to the expreſs laws of God. And perhaps, all things conſidered, it will be thought, that repreſenting this limitation of their active obedience by the laws of God or nature, as a duty to the miniſters of the ſupreme power, may prove in thoſe extravagant ſuppoſed caſes no leſs effectual for the peace and ſafety of a nation, than preaching up the power of reſiſtance to the people.

L. Further, it will probably be objected as an abſurdity in the doctrine of paſſive obedience, that it enjoineth ſubjects a blind implicit ſubmiſſion to the decrees of other men; which is unbecoming the dignity and freedom of reaſonable agents; who indeed ought to pay obedience to their ſuperiors, but it ſhould be a rational obedience, ſuch as ariſes from a knowledge of the equity of their laws, and the tendency they have to promote the public good. To which I anſwer, that it is not likely a government ſhould ſuffer much for want of having its laws inſpected and amended, by thoſe who are not legally intitled to a ſhare in the management of affairs of that nature. And it muſt be confeſſed, the bulk of mankind are by their circumſtances and occupations, ſo far unqualified to judge of ſuch matters, that they muſt neceſſarily pay an implicit deference to ſome or other, and to whom ſo properly as to thoſe inveſted with the ſupreme power?

LI. There is another objection againſt abſolute ſubmiſſion, which I ſhould not have mentioned, but that I find it inſiſted on by men of ſo great note, as *Grotius* and *Puffendorf**, who think our non-reſiſtance ſhould be meaſured by the intention of thoſe who firſt framed the ſociety. Now, ſay they, if we ſuppoſe the queſtion put to them, whether

* *Grotius de jure belli & pacis, l.* 1. *c.* 4. *ſ.* 7. *& Puffendorf de jure naturæ & gentium, l.* 7. *c.* 8. *ſ.* 7.

they

they meaned to lay every ſubject under a neceſſity of chooſing death, rather than in any caſe to reſiſt the cruelty of his ſuperiors, it cannot be imagined, they would anſwer in the affirmative. For this were to put themſelves in a worſe condition, than that which they endeavoured to avoid by entering into ſociety. For although they were before obnoxious to the injuries of many, they had nevertheleſs the power of reſiſting them. But now they are bound, without any oppoſition at all, to endure the greateſt injuries from thoſe whom they have armed with their own ſtrength. Which is by ſo much worſe than the former ſtate, as the undergoing an execution is worſe than the hazard of a battle. But (paſſing by all other exceptions which this method of arguing may be liable to) it is evident, that a man had better be expoſed to the abſolute irreſiſtible decrees, even of one ſingle perſon, whoſe own and poſterity's true intereſt it is to preſerve him in peace and plenty, and protect him from the injuries of all mankind beſide, than remain an open prey to the rage and avarice of every wicked man upon earth, who either exceeds him in ſtrength, or takes him at an advantage. The truth of this is confirmed, as well by the conſtant experience of the far greater part of the world, as by what we have already obſerved concerning anarchy, and the inconſiſtence of ſuch a ſtate, with that manner of life which human nature requires. Hence it is plain, the objection laſt mentioned is built on a falſe ſuppoſition; *viz.* That men, by quitting the natural ſtate of anarchy for that of abſolute non-reſiſting obedience to government, would put themſelves in a worſe condition than they were in before.

LII. The laſt objection I ſhall take notice of is, that in purſuance of the premiſed doctrine, where no exceptions, no limitations are to be allowed of, it ſhould ſeem to follow, men were bound to ſubmit without making any oppoſition to uſurpers, or even madmen poſſeſſed of the ſupreme authority. Which is a notion ſo abſurd and repugnant to common

common ſenſe, that the foundation on which it is built, may juſtly be called in queſtion. Now, in order to clear this point, I obſerve the limitation of moral duties may be underſtood in a twofold ſenſe, either firſt as a diſtinction applied to the terms of a propoſition, whereby that which was expreſſed before too generally is limited to a particular acceptation: and this, in truth, is not ſo properly limiting the duty as defining it. Or ſecondly, it may be underſtood as a ſuſpending the obſervation of a duty for avoiding ſome extraordinary inconvenience, and thereby confining it to certain occaſions. And in this laſt ſenſe only, we have ſhewn negative duties not to admit of limitation. Having premiſed this remark, I make the following anſwer to the objection. Namely, that by virtue of the duty of *non-reſiſtance*, we are not obliged to ſubmit the diſpoſal of our lives and fortunes to the diſcretion either of madmen, or of all thoſe who by craft or violence invade the ſupreme power. Becauſe the object of the ſubmiſſion enjoined ſubjects by the law of nature is, from the reaſon of the thing, manifeſtly limited ſo as to exclude both the one and the other. Which I ſhall not go about to prove, becauſe I believe no body has denied it. Nor doth the annexing ſuch limits to the object of our obedience, at all limit the duty itſelf, in the ſenſe we except againſt.

LIII. In morality the eternal rules of action have the ſame immutable, univerſal truth with propoſitions in geometry. Neither of them depend on circumſtances or accidents, being at all times, and in all places, without limitation or exception true. *Thou ſhalt not reſiſt the ſupreme civil power*, is no leſs conſtant and unalterable a rule, for modelling the behaviour of a ſubject toward the government, than *multiply the height by half the baſe*, is for meaſuring a triangle. And as it would not be thought to detract from the univerſality of this mathematical rule, that it did not exactly meaſure a field which was not an exact triangle, ſo ought it not to be thought an argument againſt the univerſality of the rule preſcribing paſſive

paſſive obedience, that it does not reach a man's practice in all caſes, where a government is unhinged, or the ſupreme power diſputed. There muſt be a triangle, and you muſt uſe your ſenſes to know this, before there is room for applying your mathematical rule. And there muſt be a civil government, and you muſt know in whoſe hands it is lodged, before the moral precept takes place. But where the ſupreme power is aſcertained, we ſhould no more doubt of our ſubmiſſion to it, than we would doubt of the way to meaſure a figure we know to be a triangle.

LIV. In the various changes and fluctuations of government, it is impoſſible to prevent that controverſies ſhould ſometimes ariſe concerning the ſeat of the ſupreme power. And in ſuch caſes ſubjects cannot be denied the liberty of judging for themſelves, or of taking part with ſome, and oppoſing others, according to the beſt of their judgments; all which is conſiſtent with an exact obſervation of their duty, ſo long as, when the conſtitution is clear in the point, and the object of their ſubmiſſion undoubted, no pretext of intereſt, friends, or the public good, can make them depart from it. In ſhort, it is acknowledged, that the precept enjoining non-reſiſtance is limited to particular objects, but not to particular occaſions. And in this it is like all other moral negative duties, which conſidered as general propoſitions, do admit of limitations and reſtrictions, in order to a diſtinct definition of the duty; but what is once known to be a duty of that ſort, can never become otherwiſe by any good or ill effect, circumſtance, or event whatſoever. And in truth if it were not ſo, if there were no general inflexible rules, but all negative as well as poſitive duties might be diſpenſed with, and warpt to ſerve particular intereſts and occaſions, there were an end of all morality.

LV. It is therefore evident, that as the obſervation of any other negative moral law, is not to be limited to thoſe inſtances only, where it may produce good effects; ſo neither is the obſervation of non-reſiſtance limited

limited in ſuch ſort, as that any man may lawfully tranſgreſs it, whenſoever, in his judgment, the public good of his particular country ſhall require it. And it is with regard to this limitation by the effects, that I ſpeak of non-reſiſtance, as an abſolute, unconditioned, unlimited duty. Which muſt inevitably be granted, unleſs one of theſe three things can be proved; either firſt, that *non-reſiſtance* is no moral duty: or ſecondly, that other negative moral duties are limited by the effects: or laſtly, that there is ſomething peculiar in the nature of *non-reſiſtance*, which neceſſarily ſubjects it to ſuch a limitation, as no other negative moral duty can admit. The contrary to each of which points, if I miſtake not, hath been clearly made out.

LVI. I have now briefly gone through the objections drawn from the conſequences of non-reſiſtance, which was the laſt general head I propoſed to treat of. In handling this and the other points, I have endeavoured to be as full and clear, as the uſual length of theſe diſcourſes would permit, and throughout to conſider the argument with the ſame indifference, as I ſhould any other part of general knowledge, being verily perſuaded that men as chriſtians are obliged to the practice of no one moral duty, which may not abide the ſevereſt teſt of reaſon.

ARITHMETICA

ABSQUE

ALGEBRA aut EUCLIDE

DEMONSTRATA.

Cui acceſſerunt,

COGITATA NONNULLA

DE

Radicibus Surdis, de Æſtu Aeris, de Ludo Algebraico, *&c.*

AUTORE * * * * Art. Bac. *Trin. Col. Dub.*

Maximæ Spei Puero,

D. GULIELMO PALLISER,

Reverendiſſimi Archiepiſcopi *Caſſelenſis*

FILIO UNICO

Ingenio, Solertiâ, Eruditione,

Annos longe præeunti,

Numeriſque adeo omnibus ad præſtandum

Ingens aliquod Scientiis Lumen

AC

INCREMENTUM

NATO,

Hunc Arithmeticæ Tractatum,

IN

Exiguum Summi Amoris Pignus,

OFFERT ET DICAT

AUTHOR.

PRÆFATIO

PLeroſque ſcientiarum mathematicarum procos in ipſo earundem limine cæcutientes, ſentio ſimul & doleo. Nimirum cùm ea ſit, apud nos ſaltem, mathemata diſcendi ratio, ut primò arithmetica, deinde geometria, poſtremò algebra addiſcatur, Tacqueti verò arithmeticam legamus, eam autem nemo probè intelligat, qui algebram non prælibarit; hinc fit ut plerique matheſi operam navantes, dum bene multorum minoris uſus theorematum demonſtrationes ſtudiosè evolvunt, interea operationum arithmeticarum, quarum ea eſt vis & præſtantia, ut non modò cæteris diſciplinis mathematicis, verùm etiam hominum cujuſcunque demùm ſortis uſibus commodiſſimè famulentur, principia ac rationes intactas prætereant. Quòd ſi quis tandem aliquando, poſt emenſum matheſeos curſum, oculos in prædictum Tacqueti librum retorqueat, multa ibi methodo obſcurâ, & quæ intellectum non tam illuminet quam convincat, demonſtrata; multa horrido poriſmatum & theorematum ſatellitio ſtipata inveniet.

Sed nec alius quiſquam, quod ſciam, arithmeticam ſeorſim ab algebrâ demonſtravit. Proinde è re tyronum futurum ratus, ſi hæc mea qualiacunque in lucem emitterem, ea poſtquam, ſi minùs omnia, pleraque certè per integrum ferè triennium in ſcriniis delituerint, publici juris facio. Quæ cùm præter ipſos operandi modos eorundem etiam demonſtrationes ex propriis & genuinis arithmeticæ principiis petitas complectantur, mirabitur fortaſſe quiſpiam, quòd noſter hic tractatus molc vulgares arithmeticorum libros, in quibus praxis tantùm tradatur, haud exæquæt. Hoc autem exinde provenit, quòd cùm operationum τὸ διότι explicarem in præceptis & exemplis, quæ vulgus arithmeticorum ad nauſeam uſque proſequitur, contractior fui; nec eò forſan obſcurior. Quippe tametſi cæco ad ſingulos ferè greſſus regendos opus ſit manuductore, in clarâ tamen demonſtrationum luce verſanti ſufficit, ſi quis tenendum tramitem vel ſtrictim exponat. Quamobrem omnes matheſeos candidati ad regularum arithmeticæ rationes ac fundamenta percipiendum animos adjungant, ſummopere velim & exoptem.

Neque

Neque id tanti moliminis eſt, ut plerique fortaſſe imaginentur. Quas attulimus demonſtrationes faciles (ni fallor) ſunt & conciſæ; nec principia aliunde mutuantur; ex algebrâ nihil, nihil ex Euclide tanquam notum ſupponitur. Ubique malui obviâ & familiari aliquâ ratione à priori veritatem praxeos comprobare, quam per prolixam demonſtrationum apagogicarum ſeriem ad abſurdum deducere. Radicum quadratarum & cubicarum doctrinam ex ipſâ involutionis arithmeticæ naturâ eruere tentavi. Atque ea, meo quidem judicio, ad numeroſam radicum extractionem illuſtrandum magis accommoda videtur, quam quæ ex elemento ſecundo Euclidis, aut ex analyſi poteſtatum algebraicarum vulgò adferri ſolent. Regula vulgaris pro Alligatione plurium rerum non niſi difficulter admodum & per ſpecies demonſtratur: ejus igitur loco novam, quæ vix ullâ demonſtratione indigeat, è proprio penu ſubſtitui. Regulam falſi, utpote mancam & ferè inutilem, conſultò prætermiſi. Ac, ſi nihil aliud, novitas fortaſſis aliqua placebit.

Neminem tranſcripſi; nullius ſcrinia expilavi. Nempe id mihi imprimis propoſitum fuerat, ut numeros tractandi leges ex ipſis principiis, proprii exercitii & recreationis cauſâ, deducerem: quod & deinceps horis ſubſecivis proſecutus ſum. Nec mihi hoc in loco abſque ingrati animi labe præterire liceat reverendum virum *Johannem Hall*, S.T.D. academiæ noſtræ vice-præpoſitum, ibidemque linguæ Hebraicæ profeſſorem digniſſimum, cui viro optimo quum me multis nominibus obſtringi lubens agnoſcam, tum non id minimum duco, quòd illius hortatu ad ſuaviſſimum matheſeos ſtudium incitatus fuerim.

Monſtravi porrò ad quem collimaverim ſcopum: quouſque ipſum aſſecutus ſim, penes æquos rerum æſtimatores eſto judicium. Candido quippe horum examini iſtas ſtudiorum meorum primitias libenter ſubmitto; quicquid interim ſcioli ſentiant & malevoli, parùm ſolicitus.

ARITH-

ARITHMETICÆ

PARS PRIMA.

CAP. I.

De NOTATIONE & ENUNCIATIONE *Numerorum.*

NOVEM ſunt notæ numerales, *viz.* 1, 2, 3, 4, 5, 6, 7, 8, 9, quibus unà cum cyfrâ (0) utuntur arithmetici, ut tantùm non infinitos numerorum ordines exprimant. Omne illius rei artificium in eo poſitum eſt, quòd notarum numeralium loci ratione decuplâ progrediantur. Series autem numerorum, eâ lege quoad locorum valores procedentium, in membra ſive periodos enunciationis cauſâ ſecatur: rem totam oculis conſpiciendam ſubjecta exhibet tabella,

Notarum

Notarum Numeralium Series.

Centuriæ		
Decades	349 · 758 · 192 · 003 · 505 · 739 · 047 · 32 · 568 · 918 · 300 · 052 · 704	*Quintilionum.*
Unitates		
Centuriæ		
Decades		*Quatrilionum.*
Unitates		
Centuriæ		
Decades		*Trilionum.*
Unitates		
Centuriæ		
Decades		*Bilionum.*
Unitates		
Centuriæ		
Decades		*Millionum.*
Unitates		
Centuriæ		
Decades		*Millium.*
Unitates		
Centuriæ		
Decades		*Integrorum.*
Unitates		
Uneſimæ		
Decimæ		*Partes.*
Centeſimæ		
Uneſimæ		
Decimæ		*Milleſimarum.*
Centeſimæ		
Uneſimæ		
Decimæ		*Millioneſimarum.*
Centeſimæ		
Uneſimæ		
Decimæ		*Bilioneſimarum.*
Centeſimæ		
Uneſimæ		
Decimæ		*Trilioneſimarum.*
Centeſimæ		
Uneſimæ		
Decimæ		*Quatrilioneſimarum.*
Centeſimæ		

quà

quâ exponitur notarum numeralium ſeries, in terniones diſtributa: membra autem ſeu periodi millecuplâ, loci decuplâ ratione progrediuntur. *E. g.* Numerus poſitus in loco unitatum (is per ſubjectum punctum dignoſcitur) denotat ſeptem res integras quaſcunque, vel ſaltem ut integras ſpectatas; numerus ei à dextris proximus tres partes decimas ejuſdem integri; qui verò locum immediatè præcedentem occupat, indigitat quatuor decadas eorundem integrorum. Eâdem proportione decuplâ locus quilibet ſequentem ſuperat, à præcedente ſuperatur.

Porrò cùm infinitâ unitatum multiplicatione & diviſione notarum ſeries infinitè ultra citraque unitatum locum producatur, adeóque innumeri oriantur loci; ut diſtincti eorum valores exprimantur, opus eſt ſolummodò trium vocum continuâ repetitione, modò ternio quivis ſive periodus ſuo inſigniatur nomine, utì factum in tabellâ. Nam progrediendo à loco unitatum verſus ſiniſtram, prima periodus numerat ſimpliciter unitates, ſive integra; ſecunda, millia; tertia, milliones; quarta, biliones; atque ita porró. Similiter, ſervatâ analogiâ, in periodis infra unitatem deſcendentibus, occurrunt primò partes ſimpliciter, dein milleſimæ, millioneſimæ, bilioneſimæ, &c. atque hæ quidèm partiendæ in uneſimas, decimas, centeſimas; illi vero colligendi in unitates, decadas, centurias.

Ut itaque enunciemus numerum quâvis è totâ ſerie figurâ deſignatum, 1°. reſpiciendum eſt ad valorem notæ ſimplicem; 2°. ad valorem loci; poſtremò, periodi. *E. g.* enuncianda ſit 9: in quintâ ſiniſtrorſùm periodo, nota ſimpliciter ſumpta valet novem; ratione loci, novem decadas; ratione demùm periodi, novem decadas trilionum. Proponatur 5: in tertiâ periodo, ſimpliciter ſumpta dicit quinque; ratione loci, quinque unitates; ratione periodi, quinque unitates millionum, ſeu quinque milliones. In ſecundâ infra unitatem periodo, detur 8: ſimplex notæ valor eſt octo; ratione loci, octo centeſimæ; ratione periodi, octo centeſimæ milleſimarum.

Quòd ſi numerus enunciandus non habeat adſcripta vocabula valores periodorum locorumque indigitantia, is punctatione à loco unitatum dextrorſùm ſiniſtrorſúmque inſtitutâ in terniones diſtinguatur; deinde, cuique loco & periodo aſſignato nomine, proferatur. Sit, *e. g.* numerus propoſitus 73·480·195. Notis in periodos diſtinctis, primùm quæro quinam ſint valores figuræ ad ſiniſtram primæ; quæ, quoniam collocatur in ſecundo loco tertiæ periodi, valet ſeptem decadas millionum: quia vero numeri ratione decuplâ progrediuntur, intellecto notæ primæ valore, cæterarum valores ordine ſequuntur. Sic ergo enunciabimus numerum propoſitum; ſeptem decades & tres unitates millionum, quatuor centuriæ & octo decades millium, una centuria, novem decades & quinque unitates: vel contractiùs, ſeptuaginta tres milliones, quadringenta octaginta millia, centum nonaginta quinque. Hinc cernimus quòd cyfra, licèt per ſe nil valeat, neceſſariò tamen ſcribatur, ut unicuique notæ debitum aſſignemus locum.

Facillimum erit numeros quantumvis magnos ſcribere & enunciare, modò quæ dicta ſunt perpendantur, quorum etiam ſcientia in ſequentibus maximi erit momenti: ſiquidem quâ ratione operationes arithmeticæ in digitis perficiantur ipſa docet natura; arte vero opus eſt ad eaſdem in numeris grandioribus accuratè exercendas, quæ ſane omnis in eo verſatur, ut quod opus ſimul & uno quaſi ictu peragi non ſinit humanæ mentis anguſtia, id in plures partiamur opellas, ſigillatim inquirentes digitorum aggregata, differentias, producta, &c. dein hæc ita componamus ut exhibeant ſummam, reſiduum, aut productum, &c. totale, cujus rei ratio omnis & artificium petitur ex ſimplici locorum progreſſione, & in eâ ultimò fundatur.

N. B. Non me latet arithmeticos nonnullos numerorum ſeriem aliter ac à nobis factum eſt partiri, ſc. in ſenarios (compoſitâ denominatione) loco

loco ternionum. Cum verò methodum quam tradimus ſequantur etiam * alii, viſum eſt & nobis eam (utpote ſimpliciorem) retinere.

CAP. II.

De ADDITIONE.

ADDITIONE quæritur duorum pluriumve numerorum aggregatum; quod ut obtineatur, numeri aggregandi ſub invicem ſcribantur eâ lege, ut unitates unitatibus, decades decadibus, partes decimæ decimis, *&c.* reſpondeant. Quamobrem ubi adnexæ fuerint partes decimales, oportet unitatis locum adjecto commate inſignire; deinde ſumpto à dextris initio notæ in primo loco occurrentes unà addantur; decades autem ſiquæ proveniant, adjectis punctulis notatæ ſequenti loco annumerandæ ſunt, cujus itidem numeris (reſervatis interim decadibus, quæ ad locum ſequentem pertinent) in unam ſummam aggregati infra ſcribantur. Atque ita porró.

E. g. In primo infra-ſcriptorum exemplo, 9 & 5 faciunt 14; decadem punctatam ſervo, cum 4 progredior; 4 & 8 ſunt 12, punctatâ igitur decade, 2 ſubſcribo; ad ſecundum locum accedens, reperio 6, quibus addo 2, *ſcil.* decadas in primo punctatas, 8 & 2 faciunt decadem, quam notatam ſervans, quæ ſola ſupereſt 1 ſubſcribo. Et ſic deinceps.

			l. *s.* *d.*
Addend.	2018·	523,9702	7 8 9
	8·22·5·	81,35	3 12· 5
	4369	60,2005	0 7 2
Sum.	14612	665,5207	11 8 4

* *v. g. Cl. Walliſius in Matheſ. Univerſ. & le Pere Lamy dans ſes Elemens des Mathematiques.*

Quòd ſi proponantur colligendæ res diverſarum ſpecierum, ſimili prorſus methodo operandum, dummodò habeatur ratio proportionis, juxta quam progrediuntur diverſa rerum genera. *E. g.* Quoniam *Lib. Sol.* & *Den.* non ratione decuplâ ut numeri progrediuntur, adeoque non 10 denarii ſed 12 conſtituant ſolidum, non 10 ſolidi ſed 20, libram; propterea in hiſce ſpeciebus addendis, loco decadis, numerus quilibet in denariis, duodenarius, in ſolidis, vicenarius, ſequenti loco adſcribendus eſt.

CAP. III.

De SUBDUCTIONE.

SUbductione quæritur duorum numerorum differentia, ſive quodnam ſuperfuerit reſiduum ſublato uno ex altero: cujus obtinendi cauſâ, numeri minoris nota quælibet notæ majoris ejuſdem loci ſubſcribatur; deinde ſubducendi prima dextrorſùm nota ex notâ ſupraſcriptâ auferatur, reſiduumque infra notetur; atque ita porrò, uſque dum perficiatur ſubductio totius.

Si verò accidat numerum aliquem minorem eſſe quàm ut ex eo nota ſubſcripta auferri poſſit, is decade augeatur, mutuatâ ſcil. unitate à loco ſequente.

Detur 1189 ſubtrahendus ex 32034. Numeris ut in exemplo ſubjecto ſcriptis, aggredior ſubductionem notæ primæ 9 ex ſuprapoſitâ 4; verùm cùm 4 ne ſemel quidem contineat 9, adjectâ decade, fiat 14; ex 14 ſubductis 9, reſtant 5: dein verſus ſiniſtram pergens, reperio 8, à 2 (loco 3, habitâ nimirùm ratione mutuatæ decadis) ſubducenda, quòd quoniam fieri nequit, aufero 8 à 12, & reſtant 4; proxima ſubducendi nota eſt 1, quæ quia à nihilo, ſive 0, non poteſt ſubtrahi, loco cyfræ 0, ſubſtituo 9, (9 inquam,

quam, quoniam mutuata decas unitate numero præcedenti jam ante adjectâ truncatur) ablatâ demùm 1 ab 1, reſtat nihil. Porrò peractâ ſubductione reſtant 3, quæ itidem ſubſcribo.

Haud diſſimili ratione ſubductio ſpecierum diverſarum perficitur: modò advertamus non ſemper decadem, ſed numerum qui dicit quotuplus locus quilibet ſit præcedentis, in ſupplementum defectûs notæ alicujus mutuandum eſſe.

			l.	*s.*	*d.*
	32034	7329,645	4	8	3
Subduc.	1189	3042,100	2	6	5
Reſid.	30845	4287,545	2	2	10

N. B. Ex dictis liquet arithmeticæ (quam hactenus tradidimus) artificium conſiſtere in perficiendo per partes id quod unâ vice fieri nequeat; rationem verò in additione reſervandi, in ſubductione, mutuandi decadas, à decuplâ locorum progreſſione omnino petendam eſſe.

CAP. IV.

De MULTIPLICATIONE.

Multiplicatione toties ponitur multiplicandus quoties jubet multiplicans; ſeu quæritur numerus qui eandem habeat rationem ad multiplicandum, quàm multiplicans ad unitatem. Numerus autem iſte appellatur productum ſive rectangulum, cujus latera ſeu factores dicuntur uterque tùm multiplicandus, tùm numerus per quem multiplicatur.

Ut productum duorum numerorum inveniamus, ſcripto numero multiplicante ſub multiplicando, hic multiplicetur per quamlibet notam illius, incipiendo

incipiendo à dextris; cujuſque autem producti nota prima directè ſubſcribatur notæ multiplicanti, reliquæ verſus lævam ordine ſequantur.

Peractâ multiplicatione, producta particularia in unam colligantur ſummam, ut habeatur productum totale, in quo tot loci partibus ſunt aſſignandi, quot ſunt in utroque factore.

Proponatur 30,94 ducendus in (ſive multiplicandus per) 26,5. Quinquies 4 dant 20, cujus primam figuram 0 ſubſcribo notæ multiplicanti (5), reliquam 2 ſervo; porrò 5 in 9 dant 45; 5 cum 2 ſervatis faciunt 7, quæ ſubſcribo, 4 ſequenti loco ponenda ſervans; & ſic deinceps.

	30,94 26,5	52896 24	6000 56
	15470 18564 6188	211584 105792	36 30
Prod. tot.	819,910	1269504	336000

Quoniam numeri cujuſque duplex eſt valor, ut multiplicatio rectè inſtituatur, oportet utriuſque rationem haberi; adeò ut nota quævis multiplicetur juxta valorem cùm ſimplicem tùm localem figuræ multiplicantis. Hinc nota prima cujuſque particularis producti ſcribitur ſub notâ multiplicante. *E. g.* in ſecundi exempli multiplicatore, nota 2 valet duas (non unitates, ſed) decadas; ergo in 6 (primam multiplicandi notam) ducta producet duodecim (non quidem unitates, verùm) decadas. Proinde primam producti notam in loco decadum, *h. e.* directè ſub notâ multiplicante 2, poni oportet.

Ob eandem rationem, ubi in factoribus occurrunt partes, numerus ex primâ multiplicandi notâ in primam multiplicantis ductâ genitus, tot locis detrudendus

detrudendus eſt infra notam multiplicatam, quot multiplicans dextroſùm ab unitate diſtat; adeóque tot loci in producto totali partibus ſeponendi ſunt, quot fuerant in utroque factore.

N. B. Si factori utrique aut alterutri à dextris accedant cyfræ non interruptæ, multiplicatione in reliquis notis inſtitutâ, omittantur iſtæ mox producto totali adjiciendæ: quippe cùm loci proportione decuplâ progrediantur, liquet numerum decuplum, centuplum, millecuplum, *&c.* ſuiipſius evadere, ſi modo uno, duobus, aut tribus locis promoveatur.

CAP. V.

De DIVISIONE.

DIVISIO opponitur multiplicationi; nempè productum quod hæc conficit, illa ſibi diſſolvendum ſive dividendum proponit. Numerus in diviſione inventus, dicitur *Quotiens:* ſiquidèm dicit quoties dividendus continet diviſorem, vel (quod idem eſt) rationem dividendi ad diviſorem; ſeu denique, partem dividendi à diviſore denominatam.

In diviſione, ſcriptis dividendo & diviſore ſicut in exemplorum ſubjectorum primo, captoque initio à ſiniſtris, pars dividendi diviſori æqualis, vel eum proximè ſuperans (intelligo valorem tantùm ſimplicem) interpoſito puncto ſeponatur: quærendum dein quoties diviſor in membro iſto contineatur, numeruſque proveniens erit prima quotientis nota; porrò diviſor ducatur in notam inventam, productoque à membro dividendo ablato, reſiduum infrà notetur, cui adſcriptâ ſequente dividendi notâ, confit novum membrum dividendum, unde eruatur nota ſecunda quotientis, mox in diviſorem ducenda, ut producto ex membro proximè diviſo ablato, reſiduum unà cum ſequente dividendi notâ, præbeat novum

novum membrum; atque ita porrò, uſque dum abſoluta fuerit operatio. Subductis demum locis decimalibus diviſoris ad iis qui ſunt in dividendo, reſiduum indicabit quot loci partibus aſſignandi ſunt in quotiente; quod ſi nequeat fieri ſubductio, adjiciantur dividendo tot cyfræ decimales quot opus eſt.

Peractâ diviſione, ſi quid ſuperfuerit, adjectis cyfris decimalibus continuari poterit diviſio, donec vel nihil reſtet, vel id tam exiguum ſit, ut tutò negligi poſſit; aut etiam quotienti apponantur notæ reſiduæ, ſubſcripto iiſdem diviſore.

Si uterque, dividendus nempe & diviſor, deſinat in cyfras, hæ æquali numero utrinque reſcindantur; ſi verò diviſor ſolus cyfris terminetur, eæ omnes inter operandum negligantur, totidemque poſtremæ dividendi notæ abſciſſæ, ſub finem operationis reſtituantur, ſcripto infra lineolam diviſore.

Proponatur 45832, dividendus per 67. Quoniam diviſor major eſt quam 45, adjectâ notâ ſequente fiat 458, membrum primò dividendum; hoc interpoſito puncto à reliquis dividendi notis ſecerno. 6 in 45 continetur ſepties, & ſupereſt 2; veruntamen quoniam 7 non itidem ſepties in 28 reperitur, ideò minuendus eſt quotiens. Sumatur 6; 6 in 45 invenitur ſexies, atque inſuper 9, quin & 98 continet 7 ſexies, eſt igitur 6 nota prima quotientis; hæc in diviſorem ducta procreat ſubducendum 402, quo ſublato à 458, reſtant 56; his adſcribo 3, proximam dividendi notam, unde confit novum membrum, nimirùm 563, quod ſicuti prius dividens, invenio 8 pro notâ ſecundâ quotientis: 8 in 67 dat 536, hunc ſubduco à membro 563, reſiduoque 27 adjiciens reliquam dividendi notam, *viz.* 2, habeo 272 pro novo dividendo, quod diviſum dat 4, quâ primo in quotiente ſcriptâ, dein in diviſorem ductâ, productoque ex 272 ablato, reſtant 4 quotienti, ſcripto infra lineolam diviſore, adjicienda.

Expeditior

Expeditior eſt operatio, ubi ſubductio cujuſque notæ multiplicationem immediatè ſequitur; ipſa autem multiplicatio à ſiniſtrâ dextrorſum inſtituitur. *E. g.* Sit 12199980 dividendus per 156, (*vide* exempl. 3) ſub 1219 primo dividendi membro ſcripto diviſore, conſtat hunc in illo ſepties coutineri; quamobrem 7 ſcribo in quotiente. Septies 1 eſt 7, quibus ſubductis ex 12, deleo tum notam multiplicatam 1 tum 12 partem membri undè auferebatur productum, reſiduum 5 ſuprà notans; dein accedo ad proximam diviſoris notam 5; 7 in 5 dat 35; 35 ex 51 ablatis, reſtant 16, quæ ſuprà ſcribo, deletis 51 & 5. Deinde autem 7 in 6 duco, productoque 42 ex 69 ſubtracto, ſuperſunt 27, quæ proinde noto, deletis interim tum 69 tum 6, ultimâ dividendi figurâ. Porrò diviſorem jam integrè deletum, denuò verſus dextram uno loco promotum ſcribo, perque illum membrum ſupraſcriptum (quod quidem fit ex reſiduo membri proximè diviſi ſequente notâ aucto) quemadmodum præcedens divido. Eodem modo diviſor uſque promoveatur quoad dividendum totum percurrerit.

67)458.32(684$\frac{4}{67}$	200)8200	41
402		123 2
563	2) 82 (41	367173
536	8	221999$0(78205
272	02	1566666
268	2	18333
004	00	111

Jam verò præceptorum ratio dabitur; & primùm quidem liquet, cur quotientem per partes inveſtigemus.

2. Quæri poteſt, cur *v. g.* in exemplo ſuprà allato habeatur 6 pro quotiente membri primi per diviſorem diviſi, nam 67 in 458 centuriis (pro centuriis nimirùm habendæ ſunt cùm duobus locis ſiniſtrorſùm ab unitate

diſtent) non ſexies, ſed ſexcenties continetur? Reſpondeo, reverâ non ſimpliciter 6, ſed 600 ſcribi in quotiente; duæ enim notæ poſtmodum inventæ iſtam ſequuntur, atque ita quidem quotienti debitus ſemper conſervatur valor; nam unicuique notæ tot loci in quotiente, quot membro unde eruebatur, in dividendo poſtponuntur.

3. Quandoquidem nota quælibet quotientis indicat quoties id, ex quo eruebatur, dividendi membrum diviſorem contineat; æquum eſt ut ex diviſore, in notam proximè inventam ducto, confletur ſubducendum: tunc nempe aufertur diviſor toties ad amuſſim quoties in dividendo continetur, niſi forſan æquo major aut minor ſit numerus ultimò in quotiente ſcriptus. De illo quidem errore conſtabit, ſi productum tam magnum fuerit, ut ſubduci nequeat; de hoc, ſi è contra productum oriatur tam exiguum, ut peractâ ſubductione reſiduum diviſore majus ſit vel ei æquale.

4. Ratio cur tot loci partibus ſeponantur in quotiente, quot cum iis qui ſunt in diviſore æquentur locis decimalibus dividendi, ex eo cernitur, quod numerus dividendus ſit productum, cujus factores ſunt diviſor & quotus, adeoque ille tot habeat locos decimales quot hi ambo, id quod demonſtravimus de multiplicatione agentes.

5. Patet cyfras decimales ad calceos dividendi adjectas ipſius valorem non immutare. Nam integros quod attinet, ii dummodo eodem intervallo ſupra unitates aſcendant, eundem ſortiuntur valorem; decimales verò non niſi præpoſitis cyfris in inferiorem gradum deprimuntur.

6. Quoniam quotiens exponit ſeu denominat rationem dividendi ad diviſorem, patet proportione illâ ſive ratione exiſtente eâdem, eundem fore quotientem; ſed abjectis cyfris communibus, ratio ſeu numerorum ad invicem habitudo minimè mutatur, Sic *v. g.* 200 eſt ad 100, vel (quod

(quod idem eſt) 200 toties continet 100, quoties 2 continet 1, quod ſanè per ſe manifeſtum eſt.

CAP. VI.

De Compoſitione & Reſolutione Quadrati.

PRoductum ex numero in ſeipſum ducto, dicitur numerus *quadratus.* Numerus autem ex cujus multiplicatione oritur quadratus, nuncupatur *latus*, ſive *radix quadrata*; & operatio quâ numeri propoſiti radicem inveſtigamus, dicitur *extractio radicis quadratæ*, cujus intelligendæ cauſâ juvabit geneſin ipſius quadrati, parteſque ex quibus componitur, earumque ordinem ſitumque contemplari. Veruntamen quoniam in inquirendâ rerum cognitione conſultius eſt à ſimpliciſſimis & facillimis ordiri, à contemplatione geneſeos quadrati, ex radice binomiâ oriundi, initium capiamus.

Attentiùs itaque intuendum eſt, quid fiat ubi numerus duabus notis conſtans in ſeipſum ducatur: & primò quidem manifeſtum eſt, primam à dextrâ radicis notam in notam ſuprà poſitam, ſeipſam nempè, duci; unde oritur quadratum minoris membri. Deinde verò, eâdem notâ in ſequentem multiplicandi, *i. e.* alteram radicis notam ductâ, provenire rectangulum ab utroque radicis membro conflatum conſtat. Porrò peractâ multiplicatione totius multiplicandi per primam radicis notam, ad ſecundam accedimus, quâ in primam multiplicandi notam ductâ, oritur jam denuò rectangulum duarum radicis binomiæ notarum; deinde ſecunda multiplicandi nota, *i. e.* eadem per eandem, multiplicata, dat ſecundi membri radicis binomiæ quadratum.

Hinc ergo colligimus, quadratum quodvis à radice binomiâ procreatum conſtare primò ex quadrato membri minoris, ſecundò duplici rectangulo membrorum, tertiò quadrato membri majoris.

Proponatur radix binomia, *v. g.* 23 quadranda, juxta ea quæ *cap.* 4. traduntur; primò duco 3 in 3, unde producitur 9, quadratum membri minoris. Secundò duco 3 in 2, alteram radicis notam; prodit 6, rectangulum utriuſque notæ. Tertiò, ex 2 in 3 ducto oritur jam ſecundâ vice rectangulum membrorum. Quartò, 2 in 2 gignit 4, quadratum membri majoris.

23
23

69
46

Progrediamur ad geneſin quadrati à radice trimembri; atque hic primò quidem prima radicis nota in integram radicem ducta procreat, primò, primi membri quadratum; ſecundò, rectangulum membrorum primi ac ſecundi; tertiò, rectangulum membrorum primi ac tertii. Secundò, ſecunda radicis nota multiplicans radicem dat, primò, rectangulum membrorum primi ac ſecundi; ſecundò, quadratum membri ſecundi; tertiò, rectangulum membrorum ſecundi ac tertii. Tertiò, ex tertiâ radicis notâ in radicem ductâ oritur, primò, rectangulum membrorum primi ac tertii; ſecundò, rectangulum membrorum ſecundi ac tertii; tertiò, quadratum tertii membri radicis.

Hinc porrò colligimus quadratum quodvis à radice trinomiâ genitum complecti, primò, quadratum notæ radicis primæ; ſecundò, duplex rectangulum notæ primæ in duas reliquas ductæ; tertiò, quadratum duarum reliquarum, *i. e.* bina ſingularum quadrata & earundem duplex rectangulum, quæ quidem conſtituere quadratum duarum notarum jam ante oſtendimus.

Simili methodo oſtendi poteſt quadratum 4, 5, quotlibet notarum continere, primò, quadratum notæ infimæ; ſecundò, duplex rectangulum

ex

ex infimâ in ſequentes omnes ductâ genitum; tertiò, quadratum notarum omnium ſequentium; quod ipſum (uti ex præmiſſis manifeſtum eſt) continet quadratum notæ à dextris ſecundæ, duplex rectangulum ejuſdem in omnes ſequentes ductæ, quadratum notarum omnium ſequentium; quod pariter continet quadratum notæ tertiæ, bina rectangula illius & ſequentium harumque quadratum, atque ita porrò, uſque quoad ventum ſit ad quadratum altiſſimæ radicis notæ

Inventis tandem partibus ex quibus componitur quadratum, reſtat ut circa earum ordinem ſitumque diſpiciamus. Si itaque quadratum incipiendo à dextris in biniones partiamur, ex geneſi quam ſuprà tradidimus conſtabit, primum (à ſiniſtris) membrum occupari à quadrato notæ primæ ſive altiſſimæ, ſimul ac ab eâ duplicis rectanguli ex notis primâ & ſecundâ in invicem ductis conflati portione, quæ extra primum ſequentis binionis locum redundat: ſecundi locum primum continere dictum duplex rectangulum, atque inſuper quicquid quadrati notæ ſecundæ excurrat; ſecundum capere quadratum notæ ſecundæ, & quod redundat duplicis rectanguli duarum priorum notarum in tertiam ductarum, quoad notam infimam ad locum primum tertii binionis pertinentis, & ſic deinceps. *v. g.* in exemplo appoſito, membrum primum 10 continet 9 quadratum notæ primæ 3, ſimul ac 1 quo 12 (duplex rectangulum notæ 3 in ſequentem 2 ductæ) locum primum ſecundi membri tranſcendit. Primus locus ſecundi binionis capit 2 (duplicis rectanguli notarum 3 & 2 reliquum,) atque etiam id quod extra locum proximè ſequentem redundat, &c.

```
   321
   321
 -----
   321
  642
 963
 -----
10:30:41
```

Perſpectâ jam compoſitione quadrati, ad ejuſdem analyſin accedamus. Proponatur itaque numerus quivis, (*E. g.* 103041) unde elicienda ſit radix quadrata. Hunc incipiens à dextris, in biniones (ſi par ſit locorum

corum numerus, alioqui membrum ultimum ex unicâ conſtabit notâ) diſtinguo. Quæro dein quadratum maximum in (10) membro verſùs lævam primo contentum, cujus radix (3) eſt nota prima radicis indagandæ, ipſum autem quadratum (9) à membro (10) ſubduco. Ex reſiduo (1) adjectâ (3) notâ primâ ſequentis membri confit dividendus (13), quem divido per notam inventam duplicatam (*i. e.* 6), quotiens (2) erit nota radicalis ſecunda; quâ primò in diviſorem, deinde in ſeipſam ductâ, productiſque in unam ſummam collectis, ita tamen ut poſterius uno loco dextrorſum promoveatur (*e. g.* $^{12}4$) habeo numerum ſubducendum (124), hunc aufero ex dividendo (13) aucto (0) notâ reliquâ ſecundi membri: reſiduo (6) adjicio (4) notam primam tertii binionis, ut fiat novus dividendus (64), qui diviſus per (64) duplum radicis hactenus inventæ dat (1) notam tertiam radicis indagandæ; hâc tum in diviſorem tum in ſeipſam ductâ, factiſque ut ſuprà ſimul aggregatis, ſummam (641) ſubduco à dividendo (64) aucto acceſſione notæ alterius membri tertii: eâdem plane methodo pergendum quantumvis producatur operatio.

```
103041(321
 9
-----
6)13·0
  124
  ----
 64)641
 -------
    641
    ---
    000
```

Si quid poſt ultimam ſubductionem ſuperfuerit, id tibi indicio ſit, numerum propoſitum non fuiſſe quadratum; verumtamen adjectis reſolvendo cyfris decimalibus operatio extendi poterit quouſque lubet.

Numerus locorum decimalium, ſi qui fuerint, in reſolvendo bipartitus indicabit, quot ponendi ſunt in radice, cujus ratio cernitur ex *cap.* 4.

Ratio operandi abunde patet ex præmiſſis. Nam *E. g.* adhibui (6) duplum notæ inventæ pro diviſore, propterea quòd ex traditâ quadrati

drati compoſitione, duplex rectangulum notæ illius (3) in ſequentem (2) ductæ dividendum complecti reſcîſſem, eoque adeò diviſo per duplum factoris unius (3) confactorem ejus (2) *h. e.* notam proximam radicis innoteſcere. Similiter, ſubducendum conflavi ex duplici rectangulo quotientis & diviſoris, ſimul ac quotientis quadrato in unum, eâ quâ dictum eſt ratione, collectis; quia bina illa rectangula & quadratum eo ordine in reſiduo & membro ſequente, ex quibus fiebat ſubductio, contineri deprehenderam, atque ita quidem poteſtatis reſolutio ex ipſius compoſitione facili admodum negotio deducitur.

CAP. VII.

De Compoſitione & Reſolutione CUBI.

RADIX in quadratum ducta procreat cubum. Ut ſternamus viam ad analyſin cubi, à compoſitione poteſtatis (quemadmodum in capite præcedenti factum) ſumendum eſt initium. In productione igitur cubi à radice binomiâ primum radicis membrum offendit, primò, ſuiipſius quadratum, unde cubus notæ primæ; ſecundò, duplex rectangulum membrorum, unde duplex ſolidum quadrati notæ primæ in alteram ducti; tertiò, quadratum membri alterius, unde ſolidum ex notâ primâ & quadrato ſecundæ genitum. Similiter, factâ multiplicatione per membrum ſecundum oritur primò, ſolidum notæ ſecundæ & quadrati primæ; ſecundò, duplex ſolidum notæ primæ & quadrati ſecundæ; tertiò, cubus membri ſecundi.

Continet ergo cubus à radice binomiâ procreatus ſingulorum membrorum cubos & 6 ſolida, nimirum 3 facta ex quadrato membri utriuſvis in alterum ducto.

Hinc

Hinc ratiocinio ad analogiam capitis præcedentis protracto, conſtabit, ſi (ut quadratum in biniones, ita) cubus à quantâvis radice genitus, in terniones diſtribuatur, ternionem ſeu membrum à ſiniſtris primum continere cubum notæ ſiniſtrorſum primæ, ſimul ac redundantiam (ſi quæ ſit) 3 ſolidorum quadrati ejuſdem in ſecundam ducti; locum primum ſecundi capere dicta ſolida & redundantiam 3 ſolidorum quadrati notæ ſecundæ in primam, locum ſecundum eadem 3 ſolida & redundantiam cubi notæ ſecundæ; tertium occupari à dicto cubo, ſimul ac redundantiâ 3 ſolidorum, ex quadrato notarum præcedentium in tertiam ducto genitorum; locum primum tertii membri ſolida ultimò memorata obtinere, & ſic deinceps. Hinc facilè derivabimus methodum eliciendæ radicis cubicæ, quæ eſt ut ſequitur.

Incipiendo à dextris, reſolvendum (80621568) in terniones (præter membrum poſtremum quod minus eſſe poteſt) punctis interpoſitis diſtribuo. Dein cubum maximum (64) in (80) primo verſùs ſiniſtram membro contentum ſubduco, ſcriptâque illius radice (4) in notam primam radicis quæſitæ, reſiduo (16) adſcribo (6) notam proximam reſolvendi, unde confit dividendum (166) quod divido per (48) triplum quadrati notæ inventæ: quotiens (3) eſt nota ſecunda radicis: hanc duco, primò in diviſorem; ſecundò, ipſius quadratum in triplum notæ primæ; poſtremò, ipſam in ſeipſam bis. Producta eâ lege aggregata, ut ſecundum à primo, tertium à ſecundo, uno loco dextrorſùm ponatur, $\left\{\begin{matrix}144\\108\\27\end{matrix}\right\}$ ſubduco à dividendo aucto acceſſione duarum notarum reliquarum membri ſecundi. Ad eundem modum, utut prolixa ſit operatio, numerum dividendum ſemper præſtat reſiduum, adjunctâ primâ ſequentis membri notâ: diviſorem verò, triplum quadrati notarum radicis hactenus inventarum: & ſubducendum, notâ ultimò repertâ in diviſorem ductâ, ejuſdem quadratum in triplum notarum præcedentium;

```
   80·621.568(432
   64
   ------
 48(166.21
    15507
   --------
5547)1114568
     1114568
     -------
     0000000
```

cedentium; poſtremò illius cubus, eâ quâ diximus ratione aggregati, conſtituent.

Si numerus reſolvendus non ſit cubus; quod ſupereſt, adjectis locis decimalibus, in infinitum exhauriri poteſt.

Radici aſſignanda eſt pars tertia locorum decimalium reſolvendi.

N. B. Operationes ſyntheticæ examinari poſſunt per analyticas, & viciſſim analyticæ per ſyntheticas: adeoque ſi numero alterutro ex ſummâ duorum ſubducto, reſtet alter, rectè peracta eſt additio; & vice verſâ, extra dubium ponitur ſubductio, quoties aggregatum ſubducti & reſidui æquatur numero majori dato. Similiter, ſi quotiens in diviſorem, aut radix in ſeipſam ducta, procreet dividendum, aut reſolvendum, id tibi indicio ſit, in diviſionem aut reſolutionem nullum repſiſſe vitium.

ARITHMETICÆ

PARS SECUNDA.

CAP. I.

Quid ſint FRACTIONES?

SCRIPTO diviſore infra dividendum, ductâque lineâ intermediâ, diviſionem utcunque deſignari, jam ante * monuimus. Hujuſmodi autem quotientes dicuntur numeri fracti ſeu fractiones, propterea quod numerus ſuperior, qui dicitur etiam numerator, dividitur ſeu frangitur in partes ab inferiore denominatas, qui proinde dicitur denominator: *e. g.* in hac fractione $\frac{2}{4}$ 2 eſt dividendus ſeu numerator, 4 diviſor ſeu denominator; ipſa autem fractio indicat quotientem qui oritur ex diviſis 2 per 4, *h. e.* quadrantem duarum rerum quarumvis, vel duos quadrantes unius; nempe idem ſonant.

N. B. Patet numeros qui partes decimales denotant, quique vulgo fractiones decimales audiunt, ſubſcripto nominatore, per modum fractionum vulgarium exprimi poſſe. *E. g.* ,25 valent $\frac{25}{100}$; ,004 valent $\frac{4}{1000}$ *&c.* id quod faciamus oportet, aut ſaltem factum intelligamus, quotieſcunque eæ in fractiones vulgares aut viciſſim hæ in illas reducendæ ſint, aut aliam quamvis operationem, utroſque fractos, vulgares & decimales ex æquo reſpicientem, fieri contingat.

* *cap.* 5. *pag.* 1.

CAP.

CAP. II.

De Additione & Subductione FRACTIONUM.

1. SI fractiones, quarum ſumma aut differentia quæritur, eundem habent nominatorem, ſumatur ſumma aut differentia numeratorum, cui ſubſcriptus communis nominator quæſitum dabit.

2. Si non ſunt ejuſdem nominis, ad idem reducantur, nominatores dati in ſe invicem ducti dabunt novum nominatorem; cujuſque autem fractionis numerator, in nominatores reliquarum ductus, dabit numeratorem novæ fractionis datæ æqualis. Dein cum novis fractionibus operandum ut ſupra.

3. Si integer fractioni addendus ſit, aut ab eâ ſubducendus, vel vice verſâ, is ad fractionem datæ cognominem reducatur; nempe illi in nominatorem datum ducto idem nominator ſubſcribendus eſt.

Additio	$\frac{1}{5}$ ad $\frac{2}{5}$ ſum. $\frac{3}{5}$	
Subductio	$\frac{1}{5}$ a $\frac{2}{5}$ reſid. $\frac{1}{5}$	
Additio	$\frac{2}{3}$ ad $\frac{3}{4}$, *i. e.* $\frac{8}{12}$ ad $\frac{9}{12}$ ſum. $\frac{17}{12}$	
Subductio	$\frac{2}{3}$ a $\frac{3}{4}$, *i. e.* $\frac{8}{12}$ ex $\frac{9}{12}$ reſid. $\frac{1}{12}$	
Additio	3 ad $\frac{5}{8}$, *i. e.* $\frac{24}{8}$ ad $\frac{5}{8}$ ſum. $\frac{29}{8}$	
Subductio	$\frac{5}{8}$ ex 3 *i. e.* $\frac{24}{8}$ reſid. $\frac{19}{8}$	

Primò, Dicendum eſt, cur fractiones, antequam operemur, ad idem nomen reducamus: atque id quidem propterea fit, quod numeri res heterogeneas numerantes in unum colligi, aut ab invicem ſubduci nequeant. *E. g.* Si velim addere tres denarios duobus ſolidis, ſumma non erit 5 ſol. aut 5 den. neque enim illa prius haberi poteſt quàm res nu-

meratas ad idem genus reducam, adhibendo loco duorum ſolidorum 24 denarios, quibus ſi addam 3 den. oritur aggregatum 27 den. pari ratione 2 partes tertias & 3 quartas unà colligens, non ſcribo 5 partes, tertias aut quartas; ſed earum loco uſurpo 8 duodecimas & 9 duodecimas, quarum ſumma eſt 17 duodecimæ.

Secundò, Oſtendam quod fractiones poſt reductionem idem valeant ac prius, *E. g.* quod $\frac{2}{3}$ æquentur $\frac{8}{12}$: ſiquidem uterque nominator & numerator per eundem numerum (*v. g.* 4) multiplicantur; omnis autem fractio exprimit rationem numeratoris, ſeu dividendi, ad nominatorem, ſeu diviſorem; proinde dummodo ratio illa eadem manet, fractio eundem retinet valorem; ſed ducto utroque rationis termino in unum eundemque numerum, certum eſt rationem non mutari: *e. g.* ſi dimidium rei cujuſvis ſit dimidii alterius rei duplum, erit & totum illud totius hujus duplum; quod quidem tam liquidò patet, ut demonſtratione non indigeat.

Tertiò, Integer ad fractionem reductus non mutat valorem: nam ſi 2 numerorum rectangulum per unum eorundem dividatur, quotiens erit alter; ſed in reductione integri ad fractum is in nominatorem datum ducitur, & per eundem dividitur: igitur quotiens, *h. e.* fractio valet integrum primò datum.

N. B. Utile nonnunquam erit, fractionem ad datum nomen reducere; *e. g.* $\frac{2}{6}$ ad alteram, cujus nominator ſit 9: quod quidem fit per regulam trium (de quâ vide *par.* 3 *cap.* 1) inveniendo numerum, ad quem nominator datus ita ſe habeat ac fractionis datæ nominator ad ejuſdem numeratorem; is erit numerator fracti cujus datum eſt nomen, valor autem idem qui prioris; quippe inter fractionis terminos eadem eſt utrobique ratio.

CAP.

CAP. III.

De Multiplicatione FRACTIONUM.

1. SI ducenda ſit fractio in fractionem, datarum fractionum numeratores in ſe invicem ducti, dabunt numeratorem producti; dati item nominatores procreabunt ejuſdem nominatorem.

2. Si multiplicanda ſit fractio per integrum, ducatur integer datus in numeratorem fractionis, eodem manente nominatore.

3. Si in factore alterutro, vel utroque occurrant integri, aut fractiones heterogeneæ, ei claritatis cauſâ unà colligi poterunt.

Exempla Multiplicationis.

Multiplic.	$\frac{2}{3}$ per $\frac{5}{8}$ pro. $\frac{10}{24}$ | $\frac{4}{7}$ per 2 prod. $\frac{8}{7}$
Multiplic.	2 & $\frac{3}{5}$ per $\frac{1}{2}$ & $\frac{2}{5}$ *i. e.* $\frac{13}{5}$ per $\frac{7}{0}$

1 Manifeſtum eſt quotientem eâdem proportione augeri, quâ dividendum: *E. g.* ſi 2 continetur ter in 6, continebitur bis ter in bis 6; liquet inſuper eundem eâdem proportione minui, quâ creſcit diviſor. *E. g.* ſi numerus 3 continetur quater in 12, continebitur bis 3 duntaxat bis in 12: igitur cum ut multiplicem $\frac{2}{3}$ per $\frac{5}{8}$, augenda ſit fractio $\frac{2}{3}$ ratione quintuplâ, quoniam per 5, & minuenda ratione octuplâ, quoniam non ſimpliciter per 5, ſed ſolummodo ejus partem octavam multiplicatur; duco dividendum 2 in 5, & diviſorem 3 in 8.

2. Quod

2. Quod ad regulam ſecundam, conſtat bis 4 res quaſvis æquari 8 rebus ejuſdem denominationis, quæcunque demum ſit illa.

CAP. VI.

De Diviſione FRACTIONUM.

1. FRACTIO per integrum dividitur, ducendo integrum datum in nominatorem fractionis datæ.

2. Si fractio per fractionem dividenda ſit, numerator diviſoris ductus in nominatorem dividendi dabit nominatorem quotientis, & ejuſdem nominator ductus in numeratorem dividendi dabit numeratorem quotientis.

3. Quotieſcunque admiſcentur integri aut fractiones diverſi nominis, facilius operabere ſi membra utriuſque, tum dividendi tum diviſoris, in binas ſummas colligantur.

Exempla Diviſionis.

Div. $\frac{3}{4}$ per 2 quot. $\frac{3}{8}$
Div. $\frac{4}{9}$ per $\frac{2}{5}$, quot. $\frac{20}{18}$
Div. $2\frac{1}{3}\frac{3}{2}$ per $3\frac{2}{5}$, *i. e.* $\frac{23}{6}$ per $\frac{17}{5}$

1°. Quantum ad primam regulam, ex capite præcedenti conſtat, fractionem eadem proportione minui ſeu dividi, qua multiplicatur nominator.

2°. Poſtquam

2°. Poſtquam dividens fractionem unam per aliam, *e. g.* $\frac{4}{9}$ per $\frac{2}{3}$, duxi nominatorem 9 in 2, fractio $\frac{4}{18}$ dicit tantum quoties 2 continetur in dividendo; illius verò quintuplum indicabit quoties pars quinta numeri 2 ibidem continetur; quapropter quotientem primum $\frac{4}{18}$ duco in 5, inde fit $\frac{20}{18}$.

N. B. Si fractiones datæ ſunt homogeneæ, brevius eſt & concinnius dividere numeratorem dividendi per numeratorem diviſoris, quotieſcunque illum hic metitur. Sic diviſis $\frac{6}{8}$ per $\frac{3}{8}$ quotiens erit 2, quæcunque enim numerantur 6 bis continent 3.

2. Si extrahenda ſit radix è fractione datâ, radix nominatoris radici numeratoris ſubſcripta conſtituet fractionem quæ erit radix quæſita. *E. g.* $\frac{2}{3}$ eſt radix quadrata fractionis $\frac{4}{9}$, & cubica fractionis $\frac{8}{27}$; nam ex iis quæ de multiplicatione diximus patet, $\frac{2}{7}$ in $\frac{2}{3}$ producere $\frac{4}{9}$ & $\frac{2}{3}$ in $\frac{4}{9}$ dare $\frac{8}{27}$.

CAP. V.

De Reductione Fractionum ad minimos Terminos.

1. QUONIAM fractionum quæ ex minimis terminis conſtant valor clarius agnoſcitur, utile eſt fractionis terminos, quoties id fieri poteſt, per communem aliquam menſuram dividere. Quanto autem major fuerit communis iſte diviſor, tanto minores erunt quotientes ſeu termini fractionis datæ æqualis. Oportet itaque, datis duobus numeris, intelligere methodum inveniendi maximam eorum communem menſuram, *i. e.* diviſorem maximum qui datos dividat abſque reſiduo; qui eſt ut ſequitur.

2. Divide

2. Divide majorem è datis per minorem, & diviſorem per diviſionis reſiduum, & ſi quod denuo ſuperſit reſiduum, per illud reſiduum prius, *i. e.* ultimum diviſorem dividas; atque ita porro, donec veneris ad diviſorem qui dividendum ſuum exhauriat ſive metiatur; is eſt maxima datorum communis menſura.

E. g. Proponantur 9 & 15. Divido 15 per 9, reſtant 6. Divido 9 per 6, reſtant 3: porrò diviſis 6 per 3, reſtat nihil. Ergo 3 eſt maxima communis menſura datorum numerorum 9 & 15: quod ſic oſtendo.

(*a*) 3 metitur 6, at (*b*) 6 metitur 8 demptis 3; igitur 3 metitur 9 demptis 3; ſed 3 metitur ſeipſum, metitur ergo integrum 9: atqui (*c*) 9 metitur 15 demptis 6, ergo 3 metitur 15 demptis 6, metitur vero 6; igitur metitur integrum numerum 15. Hinc patet 3 eſſe propoſitorum 9 & 15 communem menſuram: ſupereſt ut oſtendam eandem eſſe maximam. Si negas, eſto alia quæpiam major, puta 5; jam quoniam (*e*) 5 metitur 9, (*d*) 9 vero metitur 15 demptis 6, liquet 5 metiri 15 demptis 6; ſed & integrum 15 (ex hypotheſi) metitur, igitur metitur 6; 6 autem metitur 9 demptis 3, ergo 5 metitur 9 demptis 3. Quoniam igitur 5 metitur & integrum 9, & 9 demptis 3, metietur ipſum 3, *h. e.* (*f*) numerum minorem; quod eſt abſurdum.

Inventâ maximâ communi menſurâ, patet fractionem $\frac{9}{15}$ deprimi poſſe ad hanc $\frac{3}{5}$, quam priori æqualem eſſe ſic oſtendo. Omnis fractio denotat quotientem numeratoris diviſi per nominatorem; in diviſione autem, quotiens dicit rationem dividendi ad diviſorem, dum

(a) *per conſt.* (b) *per conſt.* (c) *per conſt.* (d) *per conſt.* (e) *per hyp.* (f) *per hyp.*

igitur

igitur ratio eadem manet, erit et quotiens ſeu fractio eadem. Porrò rationem non mutari, terminis ejus pariter diviſis, liquidò conſtat: *e. g.* ſi res quælibet ſit alterius rei dupla, vel tripla, erit & dimidium illius, dimidii hujus, duplum vel triplum, &c.

Qui fractiones per integros dividere & multiplicare novit, is in fractionibus (ut vocant) fractionum ad ſimplices reducendis nullam difficultatem experietur. Nam *v. g.* hæc fractio fractionis $\frac{3}{4}$ de $\frac{2}{5}$ ecquid aliud eſt quam pars quarta fractionis $\frac{2}{5}$ triplicata, ſive $\frac{2}{20}$ ducta in integram 3? Similiter, ductis in invicem tam numeratoribus quam nominatoribus, fractio fractionis fractionis, &c. ad integrum reducitur. Hæc cum tam clara ſint & per ſe manifeſta, mirum profectò per quantas ambages, quam operoſam theorematum, citationum, & ſpecierum ſuppellectilem a nonnullis demonſtrantur, dicam, an obſcurantur?

ARITHMETICÆ

PARS TERTIA.

CAP. I.

De Regulâ PROPORTIONIS.

REGULA proportionis dicitur, quâ, datis tribus numeris, invenitur quartus proportionalis. Illius quidem uſus frequens eſt & eximius: unde nuncupatur *regula aurea.* Dicitur etiam *regula trium*, ob 3 terminos datos. Porrò quartum directè proportionalem invenies, multiplicando terminum ſecundum per tertium, & productum per primum dividendo: *E. g.* ſi ut 2 ad 6, ita ſe habeat 4 ad quæſitum, duc 4 in 6, & productum 24 divide per 2, quotiens 12 erit quartus proportionalis quæſitus. Quod ſic demonſtro.

In quatuor proportionalibus, productum extremorum æquatur producto terminorum intermediorum. Nam propterea quòd numeri ſint proportionales, *h. e.* eandem habeant inter ſe rationem, ratio verò per diviſionem cognoſcatur, diviſo termino ſecundo per primum, & quarto per tertium, idem proveniet quotiens; qui (ex naturâ diviſionis) ductus in terminum primum, producet ſecundum, & in tertium, producet quartum. Jam, ſi ducamus terminum primum in quartum, vel (quod idem eſt) in tertium & quotientem continuè, & terminum tertium in ſecundum, vel (quod idem eſt) in primum & quotientem continuè, patet producta

producta fore æqualia, nam iidem ſunt utrobique factores. Sed ex naturâ multiplicationis & diviſionis conſtat, diviſo producto per unum è factoribus, quotientem eſſe alterum. Igitur, ſi dividam productum duorum terminorum intermediorum (6 & 4) per primum (2), quotiens (12) exhibebit quartum proportionalem quæſitum.

Quæſtio 1. Viator tribus horis conficit quindecim milliaria; quot conficiet novem horarum ſpatio? *Reſp.* 45. Patet enim ex quæſtione, ut 3 ad 15, ita 9 eſſe ad quæſitum: *i. e.* 3 : 15 : : 9 : ergo 135, productum ex 9 in 15, diviſum per 3, dabit quæſitum, *viz.* 45.

Quæſt. 2. Si 2 operarii 4 diebus merentur 2*s.* 5 quantam mercedem merebuntur 7 diebus? *h. e.* ut 2 in 4 ad 2, ita 5 in 7 ad quæſitum; ſive 8 : 2 : : 35? Unde invenitur quæſita merces, *viz.* 8*s.* 9*d.*

Quæſt. 3. Tres mercatores, initâ ſocietate, lucrifaciunt 100*l.* expendebat autem primus 5*l.* ſecundus 8*l.* tertius 10*l.* Quæritur quantum lucri ſingulis ſeorſim contigit? ſumma impenſarum eſt 23*l.* Dic itaque, ut 23 ad 5, ita 100 ad quæſitum: numerus proveniens indicabit quantum primo de communi lucro debetur; æquum nempe eſt, ut quam proportionem habet cujuſque impenſa ad ſummam impenſarum, eandem habeat ipſius lucrum ad ſummam lucrorum. Porrò ad eundem modum, dicendo 23 : 8 : : 100? & 23 : 10 : : 100? cæterorum lucra innoteſcent.

Proportio compoſita inverſa in ſimplices facillime reſolvitur. *V. g.* 2 lib. 5, 6 lib. homines expendunt 6 diebus: 30 quot diebus expendent 8 homines? Dic primò 2 : 5 : : 8 : ? invenies 20; dic igitur denuò 20 : 6 : 30 : ? & habebis quæſitum. Quâ verò ratione terminus quæſitus ſimul & ſemel per regulam ſatis intricatam innoteſcat, explicare ſuperfluum duco.

Quæſt. 4. Quatuor fiſtulæ implent ciſternam 12 horis; quot horis implebitur illa, ad 8 ejuſdem magnitudinis? Dicendum 8 : 4 : : 12? Proinde 4 in 12, *h. e.* 48, diviſa per 8, exhibent quæſitum, *viz.* 6. Neque in hoc caſu, ubi invertitur proportio, ulla eſt nova difficultas; nam terminis ritè diſpoſitis, ſemper habebimus bina æqualia rectangula, quorum unius notum eſt utrumque latus, alterum verò conflatur ex noto termino in ignotum ducto: quare dividendo productum illud prius per notum latus, ſeu factorem hujus, proveniet terminus ignotus. Quo autem ordine diſponendi ſint termini, ex ipſâ quæſtione palam fiet.

CAP. II.

De ALLIGATIONE.

REGULA alligationis ſimplicis dicitur, quâ, propoſitis duabus rebus diverſi pretii aut ponderis, &c. invenitur tertium quoddam genus, ex datis ita compoſitum, ut illius pretium vel pondus, &c. æquetur dato cuidam pretio vel ponderi, &c. inter propoſita intermedio. *E. g.* Pollex cubicus auri pendit uncias (18) pollex cubicus argenti, uncias (12). Quæritur pollex cubicus metalli cujuſdam ex utroque mixti, qui pendat 16 uncias; in quo problemate, pondus intermedium 16 ſuperat argenti pondus per 4, & ſuperatur ab auri pondere per 2. Jam, ſi capiamus $\frac{2}{6}$ cubi argentei, & $\frac{4}{6}$ cubi aurei, patet eas unà conflatas dare pollicem cubicum; quippe $\frac{2}{6}$ & $\frac{4}{6}$ æquantur unitati. Quin patet etiam metalli hujuſce mixti pondus æquari dato intermedio 16; nam argenti, quod levius eſt per 4, accepimus 2 partes, igitur defectus eſt 2 in 4; auri verò, quod gravius eſt per 2, accepimus 4 partes; adeóque exceſſus eſt 4 in 2, *i. e.* æqualis defectui; qui proinde ſe mutuò tollunt.

Hinc

Hinc oritur regula pro alligatione rerum duarum. Fractio quæ nominatur à ſummâ differentiarum, & numeratur à defectu minoris infra medium, indicat quantitatem majoris ſumendam; & viciſſim quæ eundem habens nominatorem, numeratur ab exceſſu majoris ſupra medium, indicat quantitatem minoris ſumendam.

Quæſt. Sunt duo genera argenti, uncia purioris valet 7, vilioris 4, quæruntur 3 unciæ argenti, quæ valeant ſingulæ 5? Reſol. conſtat ex regula, ſi accipiam $\frac{2}{3}$ unciæ vilioris, & $\frac{1}{3}$ unciæ purioris argenti, haberi unam unciam mixti quæſiti; hæc triplicata ſolvit quæſtionem.

Quod ſi res alligandæ ſint plures duabus, dicitur alligatio compoſita. *E. g.* ſunt quinque vini genera, vis maſſici eſt 1, chii 3, falerni 5, cæcubi 7, corcyræi 9: volo mixtum cujus vis ſit 4. Mixti æqualiter ex chio & maſſico, vis erit 2: nimirum dimidium ſummæ datarum 1 & 3, uti per ſe patet. Similiter, mixti æqualiter ex falerno cæcubo & corcyræo, vis erit 7, *i. e.* $\frac{1}{3}$ numeri 21, ſeu ſummæ virium miſturam hancce componentium. 2 & 7 alligo cum vi intermediâ datâ, *viz.* 4, defectus eſt 2, exceſſus 3, ſumma differentiarum 5; igitur ſumendæ ſunt $\frac{3}{5}$ miſturæ prioris, $\frac{2}{5}$ poſterioris; porrò diviſis $\frac{3}{5}$ per 2, quotiens indicat quantum ſingulorum, chii et maſſici, accipiendum ſit. Similiter, $\frac{2}{5}$ diviſæ per 3 dicent quantum falerni, &c. mixturæ quæſitæ ineſſe debet. Proinde $\frac{3}{10}$ maſſici, $\frac{3}{10}$ chii, $\frac{2}{15}$ falerni, $\frac{2}{15}$ cæcubi, $\frac{2}{15}$ corcyræi dabunt quæſitum.

Hinc cernimus, quomodo alligatio compoſita ad ſimplicem reducatur. Nimirum pondera, pretia, magnitudines, aut quæcunque demum ſunt alliganda, in binas colligantur ſummas, quæ dividendæ ſunt, utraque, per numerum terminorum qui ipſam conſtituunt: quotientes juxta regulam alligationis ſimplicis alligentur cum termino intermedio:

quæ

quæ proveniunt fractiones, diviſæ ſingulæ per numerum rerum ſummam ad quam ſpectant ingredientium, indigitabunt quantitatem ex ſingulis capiendam. Demonſtratio patet ex dictis.

N. B. In alligatione plurium rerum, quæſtio quævis innumeras admittit ſolutiones, idque ob duplicem rationem: nam primò termini deficientes cum excedentibus diverſimode colligi poſſunt; unde varii prodibunt quotientes, cum dato termino intermedio alligandi. Cavendum tamen eſt ne dicti quotientes ſint ſimul majores, aut ſimul minores medio; quod ſi eveniat, patet quæſitum eſſe impoſſibile. Secundò, unum eundemque terminum licet ſæpius repetere; unde illius portio augebitur, reliquorum verò portiones minuentur.

Libet in ſtudioſorum gratiam heic exhibere ſolutionem celebris illius problematis, ad Archimedem ab Hierone propoſiti.

Quæſt. Ex conflatis auro & argento fit corona: quæritur quantum ei inſit auri, quantum argenti? coronam interim violari non ſinit tyrannus. Reſpon. Parentur binæ maſſæ, una auri, altera argenti, quarum utraque ſit ejuſdem ponderis ac corona. Quibus paratis, patet problema, aliâ formâ, ſic proponi poſſe: datis *v. g.* libra auri, & libra argenti, invenire libram metalli ex utroque compoſiti, quæ ſit datæ intermediæ molis: igitur inquirendæ ſunt maſſarum & coronæ magnitudines. Quoniam vero coronæ ſoliditas geometrice determinari nequeat, opus eſt ſtratagemate. Singulæ ergo vaſi aquâ pleno ſeorſim immergantur; menſuretur autem quantitas aquæ ad cujuſque immerſionem profluentis, quam immerſæ moli magnitudine æqualem eſſe conſtat; immerſo utique auro, aqua exundans ſit 5, argento 9, coronâ 6. Huc igitur redit quæſtio; datis libra auri cujus magnitudo eſt 5, et libra argenti cujus magnitudo eſt 9, quæritur quantum ex ſingulis capere oporteat,

teat, ut habeamus libram metalli cujus magnitudo ſit 6: proinde alligatis 9 & 5 cum magnitudine intermedia 6, innoteſcet quantitas auri, *viz.* $\frac{3}{4}$ lib. & $\frac{1}{4}$ lib. quantitas argenti, coronæ immiſti.

Hinc patet, quam non difficile ſit problema, ob cujus ſolutionem notum illud εὕρηκα ingeminavit olim Archimedes.

CAP. III.

De Progreſſione Arithmeticâ & Geometricâ, & de Logarithmis.

Progreſſio Arithmetica dicitur ſeries numerorum, eâdem communi differentiâ creſcentium vel decreſcentium. *E. g.* In hac ſerie 1. 4. 7. 10. 13. 16. 19. 22. 25, 3 eſt communis exceſſus, quo terminus ſecundus excedit primum, tertius ſecundum, quartus tertium, & ſic deinceps: & in hac altera decreſcentium ſerie, 15. 13. 11. 9. 7. 5. 3. 1, 2 eſt communis defectus, quo terminus quilibet a præcedenti deficit.

Jam ex ipſo ſerierum harumce intuitu, & quam præmiſimus definitione, manifeſtum eſt, unumquemque terminum continere minorem extremum, ſimul ac communem differentiam, multiplicatam per numerum locorum quibus ab eodem diſtat. *E. g.* In prima ſerie terminus quintus 13 conſtat ex minore extremo 1, & communi differentia 3, ductâ in 4, *i. e.* numerum locorum quibus à minimo extremo diſtat. Hinc dato minore extremo, & communi differentiâ, terminus quivis, *e. g.* à minimo undecimus excluſive, facile inveniri poteſt, ducendo differentiam 3 in 11, & productum 33 minori extremo 1 addendo. Idem invenitur, datis majore extremo, differentia communi, & numero locorum

rum quibus terminus quæſitus à maximo ſejungitur, ducendo communem differentiam in numerum locorum datum, & productum è majore extremo auferendo. Patet etiam qua ratione, datis termino quolibet, ejuſdem indice, & communi differentiâ, terminus primus aſſignetur; et quomodo ex datis termino quovis, illius indice, & minore extremo, communis differentia, itemque ex datis termino, differentia, & minore extremo, termini index eruatur. Quin & illud etiam patet, *viz.* dimidium ſummæ duorum terminorum æquari medio proportionali arithmetico. *E. g.* 7 & 13 faciunt 20, cujus dimidium 10 eſt terminus inter datos medius *(vide ſeriem primam)*. Hæc & alia bene multa theoremata ac problemata, eorumque ſolutiones, ex ipſa progreſſionis arithmeticæ natura facile quiſquam deduxerit, præſertim ſi logiſticâ ſpecioſâ utatur. Quapropter ea exercitii cauſa tyronibus relinquo.

Progreſſio geometrica vocatur ſeries numerorum, eadem continua ratione creſcentium vel decreſcentium. *E. g.* 3. 6. 12. 24. 48. 96. ſunt in progreſſione geometrica, cujus ratio communis eſt dupla, nimirum terminus quiſque duplus eſt præcedentis. Similiter numeri hujus decreſcentis ſeriei, 81. 27. 9. 3. 1. progrediuntur ratione ſubtriplâ, *i. e.* terminus quilibet præcedentis ſubtriplus eſt ſive $\frac{1}{3}$.

Ubi obſervandum eſt, terminum quemvis conflari ex poteſtate communis rationis, ipſi cognomine, in terminum primum ductâ. *E. g.* In ſerie prima, 48, terminus excluſive quartus, producitur ex 16, poteſtate quarta numeri 2 (*i. e.* quæ generatur ex 2 ter in ſeipſum ducto, ſiquidem ipſa radix dicitur poteſtas prima) per terminum primum 3 multiplicatâ. Quamobrem ea quæ de progreſſione arithmetica diximus etiam hic locum habent, ſi pro additione & ſubductione multiplicationem & diviſionem pro multiplicatione & diviſione involutionem & evolu-

evolutionem, ſive radicum * extractionem adhibeamus. *E. g.* Quemadmodum in progreſſione arithmeticâ ſumma extremorum biſecta dat medium arithmeticum, ita in progreſſione geometricâ medius proportionalis eſt radix producti extremorum. Adeoque theoremata & problemata quod ſpectat, iis, cum illa ex nuda ſerierum contemplatione facillime eruantur, ulterius deducendis non immorabimur.

At vero unum eſt progreſſionis geometricæ theorema, ex quo olim derivata fuit, & etiamnum dependet nobilis Logarithmorum ſcientia; quodque adeò heic viſum eſt explicare.

In progreſſione geometricâ cujus principium eſt unitas, rectangulum duorum quorumlibet terminorum æquatur termino ejuſdem progreſſionis, qui pro indice habet ſummam indicum factorum. *E. g.* Si ſequentis ſeriei $\left\{\begin{matrix} 1. & 2. & 4. & 8. & 16. & 32. & 64. \\ 0. & 1. & 2. & 3. & 4. & 5. & 6. \end{matrix}\right\}$ ducamus terminum ſecundum 2 in quartum 8, productum 16 eſt terminus quintus, cujus index 4 æquatur indicibus ſecundi & quarti una collectis.

Ratio manifeſta eſt; nam quælibet poteſtas, in aliam quamcunque ejuſdem radicis ducta, procreat tertiam, cujus dimenſiones tot ſunt, quot fuere in utraque poteſtate generante. Sed in progreſſione geometrica, cujus terminus primus ſit unitas, patet reliquos omnes ſubſequentes eſſe poteſtates ex communi ratione genitas, quarum ſingulæ tot habeant dimenſiones, quot locis ab unitate diſtant.

* N. B. *Quomodo poteſtatum quarumvis radices extrahantur, lector diligens, juxta methodum quam ſecuti ſumus de quadrato & cubo eorumque radicibus agentes, inveſtigare poterit.*

Igitur ſi infinitæ progreſſioni geometricæ adſcriberetur indicum ſeries itidem infinita, ad obtinendum duorum terminorum rectangulum haud neceſſe foret unum per alterum multiplicare; oporteret ſolummodo, indicibus una collectis, quærere indicem qui aggregato æquetur; is ſibi adſcriptum oſtenderet rectangulum quæſitum. Similiter, ſi dividendus ſit unus terminus per alium, differentia indicum, ſi extrahenda ſit radix quadrata aut cubica, $\frac{1}{2}$ aut $\frac{1}{3}$ indicis, quæſitum quotum, vel radicem, indigitaret.

Hinc patet, difficiliores arithmeticæ operationes inſigni compendio exerceri poſſe, ſi conderentur tabulæ, in quibus numeri naturali ordine collocati habeant ſinguli indicem à latere reſpondentem: tunc quippe multiplicatio ſolâ additione; diviſio, ſubductione; extractio radicum, biſectione vel triſectione indicum, peragerentur. Sed indices illos, ſive logarithmos, numeris accommodare, *hoc opus, hic labor eſt*; in quo exantlando plurimi deſudarunt mathematici.

Primi quidem tabularum conditores hac fere methodo uſi ſunt. Numeris 1. 10. 100. 1000, *&c.* in progreſſione decupla exiſtentibus, logarithmos aſſignarunt 0.0000000. 1.0000000. 2.0000000. 3.0000000, *&c.* Deinde ut numeri alicujus, *v. g.* 4, inter 1 & 10 intermedii, logarithmum invenirent, adjectis utrique ſeptem cyfris, inter 1.0000000, & 10.0000000, medium proportionalem quæſiere; qui ſi minor eſſet quam 4, inter ipſum & 10.0000000, ſi verò major, inter eum & 1.0000000, medius proportionalis indagandus erat: porro inter hunc (ſi minor eſſet quam 4) & proxime majorem, ſin major, & proxime minorem, denuo quærebant medium proportionalem; & ſic deinceps, uſque dum ventum fuiſſet ad numerum, non niſi inſenſibili particula, puta $\frac{1}{10000000}$, à propoſito 4 differentem. Hujus autem logarithmus obtinebatur, inveniendo medium arithmeticum inter logarithmos numerorum

merorum 1 & 10, & alium inter ipſum & logarithmum denarii, *&c.* Jam ſi bipartiatur logarithmus numeri 4, habebitur logarithmus binarii, idem duplicatus dat logarithmum numeri 16; & ſi logarithmo quaternionis addatur logarithmus binarii, ſumma erit logarithmus octonarii. Simili methodo, ex uno logarithmo numeri 4 alii innumeri inveniri poſſunt.

Ad eundem modum, cùm cæteris numeris inter unitatem & decadem intermediis aptati eſſent logarithmi, alios quamplurimos eorum ſummæ, differentiæ, *&c.* ſuppeditarunt. Sed de his ſatis; neque enim omnia quæ ad logarithmos ſpectant tradere ſtatuimus: id duntaxat propoſitum fuit, eorum naturam, uſum, & inventionem quadantenus exponere.

MISCELLANEA MATHEMATICA:

SIVE

COGITATA NONNULLA

DE

Radicibus ſurdis, de æſtu aeris, de cono æquilatero & cylindro eidem ſphæræ circumſcriptis, de ludo algebraico; & parænetica quædam ad ſtudium matheſeos, præſertim algebræ.

AUTORE **** Art. Bac. *Trin. Col. Dub.*

EGREGIO ADOLESCENTI

D. SAMUELI MOLYNEUX,

In Academia *Dublinienſi* Sociorum Commenſali, Filio Viri Clarissimi *Gulielmi Molyneux*, paucis abhinc annis acerbo tam patriæ quàm rei literariæ fato denati.

Egregie adoleſcens,

TANTA fuit patris tui, dum viveret, apud eruditos exiſtimatio, ut me rem iis pergratam facturum arbitrer, ſi filium, ſui acuminis ac ſolertiæ hæredem, ipſum reliquiſſe palam faciam. Fatendum quidem eſt, patruum tuum, virum doctrinâ juxta ac humanitate inſigni, tale aliquid jam pridem * feciſſe. Viderat nimirum vir clariſſimus, eam eſſe tui necdum adoleſcentis indolem, ut te olim paterna preſſurum veſtigia veriſimile judicaret. Cujus tanti viri auctoritas apud me uſque eo valuit, ut deinceps magnam de te ſpem conceperim. Nunc autem, cum ipſe ſtudiorum tuorum conſcius, te ſaniori philoſophiæ & matheſi operam ſtrenue navantem cernam; quum ſpinas quibus obſepta videtur mathe-

* Vide epiſtolam *Thomæ Molyneux*, M. D. ad epiſcopum Clogherenſem, *Philoſoph. Tranſact.* N°. 282.

ſis,

ſis, quæque alios quamplurimos ab ejus ſtudio deterrere ſolent, te è contra ad alacrius pergendum ſtimulare; quum denique ad induſtriam illam & ſciendi ardorem præclaram ingenii vim ſentiam accedere; exundantem nequeo cohibere lætitiam quin in orbem literatum effluat, teque ex præcipuis (ſi modo Deus vitam largiatur & ſalutem) ineuntis ſæculi ornamentis fore, certiſſimo ſane augurio prænuntiem. Proinde, ſequentibus quantuliscunque ad te delatis, anſam hancce tecum publice colloquendi arripere geſtiebam; cum ut ipſe proprio cedam affectui, tum ut tu expectatione de te coortâ tanquam vinculo quodam, alioqui non ingrato, illi rerum pulcherrimarum ſtudio devinciare.

De RADICIBUS SURDIS.

Id mihi olim in mentem venit, ut putarem praxin algebraicam factum iri nonnihil faciliorem, ſi ablegato ſigno radicali, alia quæpiam excogitaretur poteſtatum imperfectarum radices computandi methodus, quæ ab uſitata in reliquis operationum forma minus abhorreret. Nimirum quemadmodum in arithmetica longe facilius tractantur fractiones à vulgaribus ad decimales reductæ, quia tunc notæ cujuſque loco nominatoris vicem obeunte, altera ſui parte truncantur, ſimilique forma ac integri deſcriptæ, eandemque cum iis ſeriem conſtituentes, iiſdem itidem legibus ſubjiciuntur; ſic ſi ex logiſtica etiam ſpecioſa ablegaretur nota iſta radicalis [√] quæ, ut nominator inter fractiones & integros, operationum diverſitatem inter radices ſurdas ac rationales inducit, praxis proculdubio minus intricata evaderet.

Quidni itaque radices quaſcunque ſurdas, perinde ac rationales, per nudas duntaxat literas deſignemus, *v. g.* pro $\surd b$ ſubſtituto *c* vel *d*? Quippe ſurdis ad hunc modum deſignatis, nihil intererit inter eas ac poteſtatum perfectarum radices; additio, ſubductio, multiplicatio, &c. ad eundem modum utrobique peragentur. Sed objicere in promptu eſt, vel magis quam ſignum radicale, ſpecies hac ratione multiplicatas calculum divexare. Siquidem cum nulla ſit affinitas ſeu connexio inter *b* & *c*, adeoque una ex altera agnoſci nequeat, videtur illius radix aptius deſignari per $\surd b$, cujus ſtatim ac cernitur innoteſcit ſignificatio. Reſpondeo, huic malo mederi poſſe, ſi *v. g.* Græcum alphabetum ad deſignandas radices introducamus, ſcribendo β pro $\surd b$, δ pro $\surd d$, &c.

Quo pacto non tam ipſæ literæ quam characteres variabuntur, & nota quævis ſubſtituta in tantum referet primitivam, ut ſcrupulo non ſit locus.

Quantitatis ex aliarum multiplicatione aut diviſione conflatæ radix deſignabitur per earundem radices ſimiliter multiplicatas ſeu diviſas. *E. g.* $\surd bc = \beta\kappa$, & $\surd \frac{bdm}{e} = \frac{\beta\delta\mu}{\epsilon}$

Si vero proponatur quantitas multinomia, ſeu conſtans ex pluribus membris (in quibus nulla ſit quantitas ignota) ſignis + aut — inter ſe connexis; deſignetur horum aggregatum (quod & alias quidem ſæpe fit) per unicam aliquam literam. *E. g.* fiat $a+b-c=g$, cujus radix eſt γ.

Quæris autem quid fiat ubi ignotæ quantitates notis connectantur; ſit *v. g.* poteſtas imperfecta $f+x$: nam ſi utamur ϕ & ξ partium nempe poteſtatis radicibus, ex iis nequit determinari radix totius? Quidni igitur exæquemus poteſtatem datam imperfectam alteri cuidam perfectæ, viz. $f+x=ff+2f\xi+\xi\xi$, vel $fff+3ff\xi+3f\xi\xi+\xi\xi\xi$, *&c?* Tunc enim erit $f+\xi=\sqrt[2]{f+x}$ vel $\sqrt[3]{f+x}$, *&c.*

Sed illud prætermiſſum eſt, qua ratione radicis genus dignoſcatur; utrum ſcilicet ſit quadratica, aut cubica, aut biquadratica. Num itaque quadraticis linquendi ſunt characteres Græci, reliquiſque deinceps alii itidem aſſignandi? An potius manente eodem charactere, puncto ſupra notato radicem quadratam, binis cubicam, tribus biquadraticam, atque ita porro indigitemus: *e. g.* $\dot{a}$ ſignificet radicem quadraticam quantitatis per a deſignatæ, $\ddot{a}$ radicem cubicam, $\dot{\ddot{a}}$ biquadraticam, *&c?* quo quidem modo fluxiones primæ, ſecundæ, tertiæ, &c. deſignantur. Seu denique id ſatis ducamus quod per retrogreſſum innoteſcat radicis denomi-

denominatio? Quippe inter operandum nihil intereſt cujus generis ſit radix aliqua, quandoquidem omnes abſque ſigno radicali notatæ, iiſdem ſubſint legibus, & ad eundem modum tractentur.

Cruda quidem ſunt hæc & imperfecta, quamque nullius ſint pretii ut a me proponuntur, ſat cerno. Tu autem, *clariſſime adoleſcens*, cui nec otium deeſt nec ingenium, ex hocce ſterquilinio boni aliquid fortaſſe extraxeris. Cæterum haud ſcio, an ea quæ differuimus tyronibus (reliquos iſta flocci facturos ſcio) quadantenus uſui eſſe poſſint, eorumque ope diſquiſitionis analyticæ filum nonnunquam enodetur eliminatis, cum ipſo ſigno radicali, operationibus quæ illud comitantur heterogeneis. Utut id ſit, mihi viſus ſum iis ex parte adhibitis, vulgarem *de ſurdis* doctrinam, brevius & clarius quam ab ullo quod ſciam factum eſt, poſſe explicare. Proinde rem ipſam aggredior.

Radices ſurdæ dicuntur eſſe commenſurabiles, cum earum ad invicem ratio per numeros rationales exprimi poſſit; quod ſi fieri nequeat, incommenſurabiles appellantur. Porro ſi propoſitis duabus radicibus ſurdis, quærere oporteat, utrum ſint commenſurabiles necne; inveniatur exponens rationis exiſtentis inter poteſtates quibus præfigitur ſignum radicale: hic ſi ſit poteſtas perfecta, habens eundem indicem ac radices propoſitæ, erunt illæ commenſurabiles: ſin minus, incommenſurabiles cenſendæ ſunt. *E. g.* Sint radices propoſitæ $\sqrt[2]{24}$ & $\sqrt[2]{54}$. $\frac{4}{9}$ fractio quadrata exponit rationem poteſtatis unius 24 ad alteram 54; adeoque radices ſunt commenſurabiles, viz. $\sqrt[3]{24} : \sqrt[3]{54} :: 2 : 3$. Proponatur denuo $\sqrt[3]{320}$ & $\sqrt[3]{135}$: ratio numeri 320 ad 135 exponitur per $\frac{64}{27}$, cubum nempe perfectum, cujus radix $\frac{4}{3}$ indicat rationem radicis unius $\sqrt[3]{320}$ ad reliquam $\sqrt[3]{125}$. Demonſtratio manifeſta eſt, ſiquidem norunt omnes radices quadratas eſſe in ratione ſubduplicata, cubicas in ſubtriplicata, biquadraticas in ſubquadruplicata, & ſic deinceps poteſtatum reſpectivarum.

Quod ſi radices ſint heterogeneæ quarum exploranda eſt ratio, ad idem genus reducantur, involvendo numeros ſigno radicali affixos, ſingulos juxta indicem radicis alterius; quibus ſic involutis præfigenda erit nota radicalis cum indice ex indicibus primo datis in ſe mutuo ductis conflato. *E. g.* Sint radices ſurdæ heterogeneæ $\sqrt[2]{5}$ & $\sqrt[3]{11}$. Cubatis 5, & quadratis 11, proveniunt 125 & 121: his præfixum ſignum radicale cum indice 6 præſtat radices homogeneas $\sqrt[6]{125}$ & $\sqrt[6]{121}$. Hujus operationis ut cernatur ratio, deſignemus $\sqrt[2]{5}$ per ſpeciem quamvis ſimplicem, puta *b*, & $\sqrt[3]{11}$ per *c*; eritque $\sqrt[2]{bb} = \sqrt[2]{5}$, & $\sqrt[3]{ccc} = \sqrt[3]{11}$, & $\sqrt[6]{bbbbbb} = \sqrt[6]{125}$, & $\sqrt[6]{cccccc} = \sqrt[6]{121}$. Ubi porro patet quod $\sqrt[6]{bbbbbb} = \sqrt[3]{bb}$ & $\sqrt[6]{cccccc} = \sqrt[3]{ccc}$.

Additionem quod attinet radicum ſurdarum, illa, ſi ſint commenſurabiles, fit præfigendo ſummam terminorum rationis ſigno radicali, cui ſuffigendus eſt communis diviſor, cujus ope dictæ rationis termini innotuerunt. *E. g.* $\sqrt[2]{24} + \sqrt[2]{54} = 5\sqrt[2]{6}$. Nam ex antedictis, & iis quæ ſequuntur de multiplicatione, $\sqrt[2]{24} = 2\sqrt[2]{6}$, & $\sqrt[2]{54} = 3\sqrt[2]{6}$. Ad eundem modum fit ſubductio, niſi quod differentia terminorum exponentis ſigno radicali præfigatur. Si addendæ ſunt aut ſubducendæ radices ſurdæ incommenſurabiles, mediantibus ſignis + aut — connectantur. *E. g.* $\sqrt{6} + \sqrt{3}$ & $\sqrt{6} - \sqrt{3}$ ſunt ſumma & differentia radicum numerorum 6 & 3; quo quidem modo ſurdis adduntur aut ſubducuntur etiam numeri rationales.

Si radix ſurda per aliam homogeneam multiplicanda ſit; rectangulo poteſtatum præponatur nota radicalis, ſimulque index communis. *E. g.* $\sqrt[2]{3} \times \sqrt[2]{7} = \sqrt[2]{21}$ & $\sqrt[3]{g} \times \sqrt[3]{x} = \sqrt[3]{gx}$. Ad cujus praxeos demonſtrationem, deſignentur radices numerorum 3 & 7 per *b* & *d*, ut ſit $bb = 3$ & $dd = 7$, & liquido conſtabit, quod $\sqrt[2]{bb\,dd} = bd$ i. e. radix quadrata producti æquatur producto radicum quad. Idem ad eundem modum oſtendi poteſt de aliis quibuſcunque radicibus, cubicis, biquadraticis, &c.

Radices

Radices heterogeneæ, priuſquam multiplicentur, ad homogeneas reducendæ ſunt. Si numerus rationalis in ſurdum ducendus ſit, elevetur ille ad poteſtatem datæ imperfectæ cognominem, cui præfigatur nota radicalis, unáque ejuſdem poteſtatis index. Cætera ut prius. *E. g.* $5 \times \sqrt[3]{4} = \sqrt[3]{125} \times \sqrt[3]{4} = \sqrt[3]{500}$. Vel brevius ſic, $5\sqrt[3]{4}$; & generaliter $b \times \sqrt[a]{c} = \sqrt[a]{b^a c}$, vel $b\sqrt[a]{c}$.

Diviſionem quod attinet, quoties dividendus & diviſor ſunt ambo radices ſurdæ, ablata (ſi qua ſit) heterogeneitate, nota radicalis cum proprio indice quotienti poteſtatum præfixa, quotum quæſitum exhibebit. *E. g.* $\sqrt[2]{7} \div \sqrt[2]{3} = \sqrt[2]{\frac{7}{3}} = \sqrt[2]{2\frac{1}{3}}$. Si vero ex duobus alteruter duntaxat numerus ſeu ſpecies ſigno radicali afficitur; reliquus, juxta indicem radicis datæ involutus, notæ radicali ſuffigatur: deinde ut prius. *E. g.* $\sqrt[3]{96} \div 4 = \sqrt[3]{96} \div \sqrt[3]{64} = \sqrt[3]{\frac{96}{64}} = \sqrt[3]{\frac{3}{2}}$. Vel ſine præparatione $\frac{\sqrt[3]{96}}{4}$. Et generaliter $\sqrt[a]{c} \div b = \sqrt[a]{\frac{c}{ba}}$ vel $\frac{\sqrt[a]{c}}{ba}$. Hæc, velut præcedentia, facillime demonſtrantur.

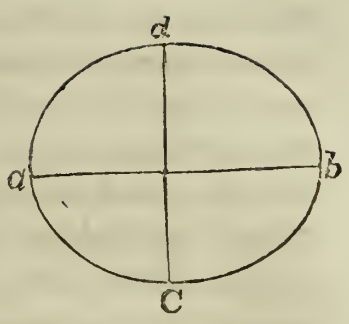
De Æstu Aeris.

Non ita pridem incidi in librum cui titulus, *De Imperio Solis & Lunæ in Corpora humana*, authore viro cl. M. D. & S. R. S. Qui ſane quantus ſit, & quantulus ſim ipſe, non ignoro. Sed ut libere dicam quod ſentio, ſententiam ejus *De Æſtu Aeris*, quam ibidem explicatam dat, utpote celeberrimi *Newtoni* principiis innixam, ambabus ulnis amplexus ſum. Verumtamen haud ſcio, an author ingenioſus phænomenôn quorundam iſthuc pertinentium cauſas tam recte aſſecutus ſit. Quam vero juſta ſit dubitandi ratio, tu, cujus perſpectum habeo acumen, optime judicabis.

Tribuit

Tribuit vir cl. altiorem aeris circa æquinoctia tumorem figuræ ſphæroidali terræ: differentiam inſuper inter aeris intumeſcentiam, quæ à luna meridionali, & illam quæ à luna (ut ita loquar) antimeridionali in ſphæra obliqua excitatur, eidem cauſæ acceptam refert. Ego vero neutrius iſtorum phænomenôn explicationem ab oblata ſphæroide petendam duco. Propterea quod, primo, quamvis ſententia quæ maſſam aereo-terreſtrem ea eſſe figura contendit, rationibus tam phyſicis quam mathematicis comprobetur, & nonnullis item phœnomenis pulchre reſpondeat; non tamen apud omnes uſque adeo obtinet, ut nulli veteris, vel etiam oppoſitæ ſententiæ fautores, iique non minimæ notæ viri, hodie reperiantur. Et ſane memini, D. *Chardellou* aſtronomiæ peritiſſimum, abhinc plus minus ſeſquianno, mihi indicaſſe, ſibi ex obſervationibus aſtronomicis axem terræ diametro æquatoris compertum eſſe longiorem: adeoque terram eſſe quidem ſphæroidem, ſed qualem vult *Burnetius*, ad polos aſſurgentem, prope æquatorem verò humiliorem. Attamen quod ad me attinet, mallem quidem viri clariſſimi obſervationes potius in dubium vocare, quam argumentis quæ terram eſſe oblatam demonſtrant obviam ire. Nihilominus, quoniam ſententia iſta non omnibus æque arridet, illam tanquam principium ad phænomenon ullum explicandum adhiberi nollem, niſi res aliter commode explicari nequeat. Sed ſecundo, tantum abeſt quod ſupradictorum effectuum explicatio ſphæroidalem terræ figuram neceſſario poſcat, ut vix ullam inde lucis particulam mutuari videatur: id quod, appoſitis quæ in hanc rem ſcribit vir clariſſimus, oſtendere conabor. *Altius* (inquit) *ſolito ſe attollit aer circa duo æquinoctia, quoniam cum æquinoctialis linea illi globi terreſtris circulo adverſa reſpondeat qui diametrum habet maximam, utrumque ſidus dum in illa verſatur terræ eſt vicinius.* De Imp. Sol. & Lun. *p.* 9. Jam vero, utrum vicinior iſte luminarium ſitus par ſit attollendo aeri in cumulum ſolito ſenſibiliter altiorem, merito ambigi poteſt. Etenim tantilla eſt differentia inter axem tranſverſum & conjugatum ellipſeos, cujus volutione gignitur ſphærois terreſtris, ut illa

ad



ad ſphæram quamproxime accedat. Verum ut accuratius rem proſequamur, deſignet *a c b d* ſectionem per polos maſſæ aereo-terreſtris, in qua ſit *d c* axis, *a b* diameter æquatoris. Jam inito calculo, deprehendi vim lunæ attractricem in *b* vel *a* non eſſe $\frac{1}{4000}$ ſui parte fortiorem quam foret in *c* vel *d*, ſi illa polo alterutri directe immineret, & proinde differentiunculam iſtam effectui ulli ſenſibili edendo imparem omnino eſſe. Conſiderandum etiam, lunam ab æquatore nunquam tertia parte arcus *b d* diſtare, dictamque proinde quantulamcunque differentiam adhuc valde minuendam eſſe. Quod autem de luna diximus, id de ſole, cum multis vicibus longius abſit, adhuc magis conſtabit.

Verum quidem eſt, D. *Mead* alias inſuper cauſas æſtûs prope æquinoctia altioris attuliſſe; viz. *agitationem fluidi ſphæroidis in majori orbe ſe revolventis majorem, præterea vim centrifugam effectum habentem eo loci longe maximum.* Quod ad primam, etſi illa prima fronte nonnihil præ ſe ferre viſa ſit, fatendum tamen eſt, me non omnino percipere, quomodo aliquid inde ad diſtinctam rei propoſitæ explicationem faciens colligi poſſit. Quod ad ſecundam, conſtat ſane vim centrifugam prope æquatorem eſſe longe maximam, & propterea maſſam aereo-terreſtrem figuram oblatæ ſphæroidis induiſſe: quid vero aliud hinc ſequatur non intelligo.

Verum etiamſi concedamus aerem, propter cauſas a clariſſimo viro allatas, circa æquinoctia ad æquatorem ſupra modum tumefieri; non tamen inde apparet, quamobrem apud nos, qui tam procul ab æquatore degimus, tum temporis altius ſolito attollatur: quinimo contrarium ſequi videtur. Sequenti pagina ſic ſcribit D. *Mead. Ut finem tandem faciam, in iiſdem parallelis ubi lunæ declinatio eſt, illum cœli polum*

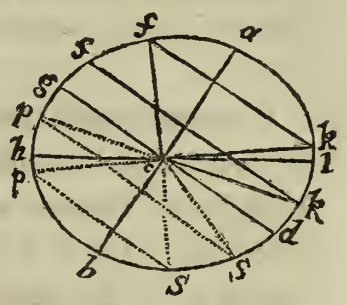
lum verſus qui altiſſimus inſurgit, validiſſima eſt attractio, cum illa ad ejus loci meridianum verticem accedit, minima vero, ubi pervenit ad meridianum loci oppoſiti; quod contra contingit in parallelis his adverſis. Cauſa eſt in ſphæroide terræ ætheriſque figura. Ego vero cauſam non eſſe in terræ & ambientis ætheris figura propterea puto, quod poſitâ terrâ vel perfecte ſpherica, vel etiam oblonga, idem certe eveniret, uti infra patebit. Reſtat ut harum rerum explicationem ipſe aggrediar, ſiquidem eo præſertim nomine ſuſpecta mihi fuit ratio a ſphæroidali terræ figura deducta, quod, nulla ipſius habita ratione, res tota clariſſime ſimul ac facillime exponi poſſe videbatur.

Newtonus, Operis ſui Phyſico-Mathematici *Lib.* 3. *Prop.* 24. ubi æſtuum marinorum phænomena explicat, hæc habet: *Pendet etiam effectus utriuſque luminaris ex ipſius declinatione ſeu diſtantia ab æquatore. Nam ſi luminare in polo conſtitueretur, traheret illud ſingulas aquæ partes conſtanter, abſque actionis intenſione & remiſſione, adeoque nullam motus reciprocationem cieret. Igitur luminaria recedendo ab æquatore polum verſus effectus ſuos gradatim amittent, & propterea minores ciebunt æſtus in ſyzygiis ſolſtitialibus quam in æquinoctialibus.* Atqui non alia cauſa videtur quærenda ullius phænomeni æſtus aerei, quam quæ ad ſimilem effectum in æſtu marino excitandum ſufficiat. Sed ut id quod à viro per totum orbem longe celeberrimo breviter adeoque ſubobſcure traditum eſt, uberius exponam; ſit in priore figura *a d c b* meridianus, & *a b* axis maſſæ aereo-terreſtris; ſol autem & luna in polo conſtitui concipiantur. Manifeſtum eſt, quamvis maſſæ aereæ partem, puta *d*, durante circumvolutione diurna, eandem ſemper diſtantiam à luminaribus tueri, adeoque vi ubique æquali in eorum corpora trahi. Proinde aer non uno tempore attollitur, alio deprimitur, ſed per totum diem in eadem hæret altitudine. Verum ſecundo, in eadem figura repræſentet *a c b d* æquatorem aut parallelum quemvis, luminaria interim in plano æquinoctiali exiſtant; quo tempore manifeſtum eſt, tum ipſum

æqua-

æquatorem, tum ſingulos parallelos, ellipticam induere figuram. Manifeſtum etiam eſt, aerem qui nunc *a*, apicem axis tranſverſi, obtinet, adeoque altiſſimus inſurgit, poſt ſex horas, *c*, extremum axis conjugati, ubi humillimus deprimetur, occupaturum, maximamque proinde motus reciprocationem cieri. Ut igitur rem omnem ſimul abſolvam, gibbos ſphæroidis æſtuoſæ triplici ratione locari concipiamus; vel in polis, vel in æquatore, vel in locis intermediis. In primo caſu, eſſet planum rotationis diurnæ ad axem ſphæroidis perpendiculare, adeoque circulus; unde nullus foret æſtus: in ſecundo, eſſet ad eundem parallelum, adeoque ellipſis, inter cujus axes maxima ſit differentia; unde maximi forent æſtus: in tertio, quo magis ad ſitum perpendicularem accederet, eò circulo vicinius eſſet, adeoque minores forent æſtus.

Reliquum eſt ut demonſtrem, differentiam quæ eſt in ſphæra obliqua inter æſtum quemvis & ſubſequentem, ubi luna extra æquatorem vagatur, terrâ poſita vel oblata, vel ad amuſſim ſphærica, vel etiam oblonga, perinde cauſatum iri. Sit *a b* axis mundi, *g d* æquator, *k* locus quivis, *f k* loci parallelus, *h l* axis ſphæroidis æſtuoſæ ob actionem, potiſſimum, lunæ utrinque tumentis. Luna autem prope *l* conſtituatur. Demonſtrandum eſt *c k* altitudinem aeris, luna prope loci meridianum exiſtente, majorem eſſe *c f*, aeris altitudine, ubi luna meridianum loci oppoſiti tranſierit. Ducatur *p s* parallelus priori ex adverſo reſpondens, & producantur *c k*, *c f* ad *p* & *s*. Per conſtructionem arcus *p h* æqualis eſt arcui *k l*; ergo arcus *f h* major eſt arcu *k l*; ergo propter ellipſin recta *f s* minor eſt recta *k p*, & *f c* minor *k c*. Q. e. d.



De Cono *æquilatero &* Cylindro, *eidem ſphæræ circumſcriptis.*

LEMMA.

LAtus trianguli æquilateri eſt ad diametrum inſcripti circuli, ut $\sqrt{3}$ ad 1; & perpendicularis ex angulo quovis ad latus oppoſitum demiſſa, eſt ad eandem, ut 3 ad 2.

Hæc cuivis, algebram & geometriam utcunque callenti, facile conſtabunt.

PROBLEMA.

Invenire rationem quæ exiſtit inter cylindrum & conum æquilaterum eidem ſphæræ circumſcriptos?

Ponamus diametrum & peripheriam baſis cylindri eſſe ſingulas unitatem. Eruntque, per lemma, diameter baſis coni ejuſdemque peripheria ſingulæ $\sqrt{3}$. Proinde $1 \times \frac{1}{4} = \frac{1}{4}$ = baſ. cylindri; & $\frac{1}{2}$ = ſummæ baſium. Et $\sqrt{3} \times \frac{1}{4}\sqrt{3} = \frac{3}{4}$ = baſ. coni, & ſuperficies cylindri ſeu quadruplum baſeos = 1. Et ſuperficies ſimplex coni $= \frac{3}{2} = \frac{\sqrt{6}}{4} \times \sqrt{6}$. Nam $\sqrt{\frac{3}{2}}$ (*h. e.* media proportionalis inter $\sqrt{3}$ latus coni, & baſis radium ſeu $\sqrt{\frac{3}{4}}$) eſt radius circuli æqualis ſuperficiei conicæ. Et per præcedentia $1 + \frac{1}{2} = \frac{3}{2}$ = ſup. tot. cylindri, & $\frac{3}{2} + \frac{3}{4} = \frac{9}{4}$ = ſup. tot. coni. Porro per hypotheſin & lemma, axis cylindri eſt 1, & coni $\frac{3}{2}$. Soliditas autem cylindri $= \frac{1}{4} \times 1 = \frac{1}{4}$, & ſoliditas coni $= \frac{3}{4} \times \frac{1}{2} = \frac{3}{8}$. Hinc, comparatis inter ſe homogeneis, eruitur ſequens

THEO-

THEOREMA.

Inter conum æquilaterum & cylindrum eidem ſphæræ circumſcriptos eadem obtinet ratio ſeſquialtera, quoad ſuperficies totas, ſuperficies ſimplices, ſoliditates, altitudines, & baſes.

Duobus abhinc annis theorema illud non ſine admiratione aliqua inveni. Nec tamen propriam ingenii vim aut ſagacitatem ullam, quippe in re tam facili, ſed quod *Tacquetus* notiſſimus matheſeos profeſſor tantopere gloriatus ſit de invento cui impar non ſit tyro, id demum admiratus ſum. Nempe is invenerat partem aliquam theorematis præfati, *viz.* quod *conus æquilaterus ſit cylindri, eidem ſphæræ circumſcripti, ſoliditate & ſuperficie tota ſeſquialter; quodque adeo continuata eſſet ratio* inter conum æquilaterum, cylindrum, & ſphæram. Hæc eſt ipſa illa propoſitio, ad quam ſpectat ſchema, quod præfati authoris tractatus *De Theorematis* ex *Archimede* ſelectis, in ipſa fronte, una cum epigraphe inſcriptum præfert. Quin etiam videas quæ dicat Jeſuita in præfatione, in ſcholio ad *Prop* 32, & ſub finem propoſitionis 44^tæ^ ejuſdem tractatus: ubi theorema hocce tanquam illuſtre aliquod inventum, & *Archimedæorum* æmulum oſtentat. Idem quod *Tacquetus*, etiam Cl. *Walliſius* in additionibus & emendationibus ad *Cap.* 81. algebræ ſuæ, à D. *Caſwello* ope arithmetices infinitorum demonſtratum, exhibet. Quod ipſum, quoad alteram ejus partem, facit D. *Dechales* in libro ſuo de indiviſibilium methodo, *Prop.* 20. Sed tam ipſa indiviſibilium methodus, quam quæ in ea fundatur arithmetica infinitorum, à nonnullis minus Geometricæ cenſentur.

Integrum autem theorema à nemine, quod ſciam, antehac demonſtratum fuit. Attamen ſi verum eſt quod opinatur *Tacquetus*, *idcirco* Archimedi *inter alia tam multa & præclara inventa, illud quo cylindrum*

inſcriptæ ſphæræ ſoliditate & ſuperficie ſeſquialterum eſſe demonſtrat, præ reliquis placuiſſe, quod corporum, & ſuperficierum corpora ipſa continentium, eadem eſſet atque una rationalis proportio: ſi, inquam, hoc in cauſa fuit, cur is cylindrum ſphæræ circumſcriptum tumulo inſculptum voluit; quid tandem faceret ſenex ille Siculus, ſi unam eandemque rationalem proportionem bina corpora quintuplici reſpectu intercedere deprehendiſſet? Illud tamen quam facile ex ejus inventis profluat, modo vidimus.

Simili fere methodo ac nos illud, omnia Tacqueti theoremata Archimedæis ſubjuncta, adde & centum iſtiuſmodi alia ſi cui operæ pretium videbitur, haud difficile erit invenire & demonſtrare.

De LUDO ALGEBRAICO.

SUB idem tempus quo theorema illud, ludum etiam algebraicum inveni. Quippe cum vidiſſem è familiaribus meis nonnullos, per dimidios ferme dies, Scacchorum ludo gnaviter incumbentes, acre eorum ſtudium in re nihili admiratus, rogavi quidnam eſſet quod tantopere laborarent? Illi porro pergratum animi exercitium renuntiant. Hoc ego mecum reputans, mirabar quamobrem tam pauci ad matheſin, utiliſſimam ſanè ſcientiam eandemque jucundiſſimam, animum applicarent. An quod difficilis ſit? Sed multi & ingenio valent, nec laborem in nugis faſtidiunt ullum. An potius, quod gratiſſimum animi exercitium non ſit? Sed quænam, quæſo, eſt illa ars, aut diſciplina, aut quodcunque demum opus, quod omnem animi facultatem, ſolertiam, acumen, ſagacitatem pulchrius exerceat? Sed ludus eſt matheſis? Nihilo ſecius jucunda: eo tamen ſi veniſſet nomine, tunc forſan lepidi iſti homunciones, qui tempus ludendo terunt, ad ejus ſtudium ſe protinus accingerent. Subiit adhæc ſapientiſſimi viri *Johannis Lockii*, in re non multum abſimili, conſilium. Sequentem proinde luſum ad praxin algebræ exercendam, rudi fateor Minerva,

Tabula Lusoria

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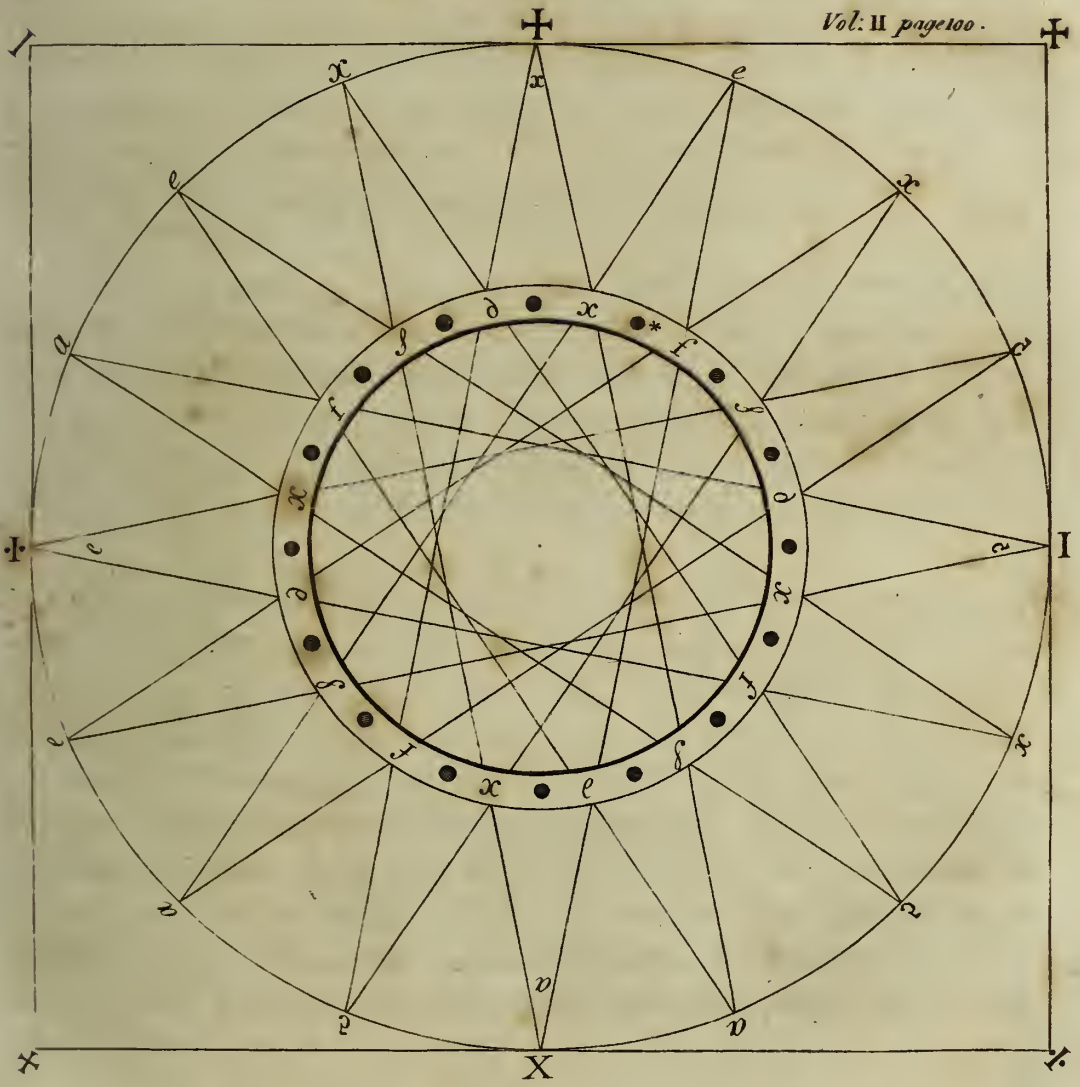

nerva, excogitavi, ſed qualis adoleſcenti, aliis præſertim ſtudiis occupato, facilè ſpero condonabitur.

Problemata algebraica immediate conſtituunt æquationes datæ, quæ in quæſtionibus determinatis quantitates quæſitas numero exæquant. Quælibet autem æquatio duobus conſtat membris, æqualitatis ſigno connexis, in quorum utroque conſiderandæ veniunt, primo, ſpecies, utrum ſcilicet quantitates datas aut quæſitas deſignent; deinde, ſigna quibus connectuntur. Efficere itaque ut hæc omnia ad conſtituendas quæſtiones ſorte obveniant, ludumque tam ex quæſtionum formatione, quam ex earundem reſolutione, concinnare operam damus.

In aſſerculo, qualis ad Dominarum aut Scacchorum luſum vulgo adhiberi ſolet, depingatur circulus quadrato inſcriptus, reliquaque omnia quæ in appoſito ſchemate continentur; niſi quod loco circellorum nigrantium facienda ſint foramina. Quibus peractis, habebimus tabulam luſoriam. Parandus inſuper eſt ſtylus tenuis è ligno, qui alicui ex dictis foraminibus infigatur. Reliquum eſt ut horum uſum exponamus.

Ut vides, operationum logiſticarum ſymbola ad latera & angulos quadrati ſcribuntur: porro latera prioribus, anguli vero poſterioribus, æquationum membris ſigna impertiunt. Circulus autem inſcriptus à ſedecim cuſpidibus in totidem partes æquales diſpeſcitur, ita ut tres cuſpides ad latus & angulum quemvis ſpectent, ſed aliæ directe, aliæ oblique: quæ oblique latus aliquod aut angulum reſpiciunt, eæ angulo & lateri communes ſunt; quæ vero directe latus aliquod intuentur, eæ ad angulum nullum pertinent, ſed ad utroſque adjacentes pariter referuntur. Et viciſſim, quæ angulum aliquem directe intuentur, eæ ad latus nullum pertinent, ſed ad utraque adjacentia pariter referri cenſendæ ſunt.

In formanda itaque quæſtione, primo obſervanda eſt cuſpis quam ſtylus reſpicit, latuſque & angulum ad quos pertineat; horum ſigna notentur, quippe quæ, ut diximus, ſpecies utriuſque cujuſlibet æquationis membri connectent. Dein, ſtylo literæ ad prædictam cuſpidem ſcriptæ impoſito, numera 1, eoque inde juxta rectæ lineæ ductum tranſlato (ut faciunt aſtrologi, nominum quibus feriæ appellantur rationem aſſignantes) ad literam oppoſitam, numera 2. Tunc ad alteram lineæ, tanquam continuata eſſet per annulum intermedium, extremitatem pergens, numera 3; & ſic deinceps, donec litera primæ cuſpidi adjacens recurrat. Hinc recta deſcendens ad cuſpidem in convexitate interioris circuli terminatam, foramini alterutro adjacenti infige ſtylum.

Numerus ultimo numeratus indicabit, quot quantitates quæſitæ, vel (quod idem eſt) quot æquationes datæ fuerint in quæſtione. Harum membra priora quantitates ignotæ alternatim ſumptæ & ſigno laterali connexæ, poſteriora quantitates cognitæ vel incognitæ (prout determinarit litera ad cuſpidem internam ſcripta) quæſitis ſigno angulari alligatæ, conſtituent. Porro *d* adhibendas quantitatum cognitarum ſpecies diverſas, *ſ* unam ſolummodo, *f* figuras numerales 2, 3, 4, &c. *x* quantitates quæſitas repetendas eſſe indicat. Notandum autem, in cujuſque æquationis membro poſteriore non alias poni quantitates ignotas, quam quæ in primo membro ſequentis æquationis reperiantur. Dicta exemplis clareſcent.

Ponamus itaque ſtylum occupare foramen ſtellula inſignitum, cuſpiſque quam reſpicit pertinebit ad latus cujus ſignum eſt +, & ad angulum cujus ſignum eſt ×, quæ ſigna in charta noto, laterale à ſiniſtris ſive primum, deinde angulare. Porro *e* ad cuſpidem ſcribitur, ad quam numero 1; inde (liberum autem eſt è duabus lineis utriuſvis ductum ſequi) ſiniſtrorſum pergens offendo *a*, ad quam numero 2; hinc tranſiens ad *z* numero 3; inde autem tranſverſim eunti denuo obverſatur *e*, litera primæ

primæ cuſpidi appoſita, ad quam numerans 4, recta deſcendo ad cuſpidem interiorem litera *d* inſignitam. Erunt igitur quatuor quantitates quæſitæ in quæſtione, quæ ſigno laterali + alternatim connexæ, conſtituent prima æquationum datarum membra. Poſteriora vero fient ex quantitatibus ignotis & notis (propter *d*) diverſis per ſignum angulare, nimirum ×, conjunctis; ad hunc modum:

$$\begin{aligned} a + e &= yb & a &= ? \\ e + y &= zc & e &= ? \\ y + z &= ad & y &= ? \\ z + a &= ef & z &= ? \end{aligned}$$

Quod ſi ponamus ſtylum foramini præcedenti infixum eſſe, quo pacto + laterale directe intuebitur, lineæque ſiniſtræ ductum ſequamur, provenient tres quantitates inveſtigandæ, & cuſpis interior habebit literam *f*. Unde numerus æquationum datarum, & priorum earundem membrorum ſigna, itemque poſteriorum ſpecies determinantur. Sed quoniam in hoc caſu cuſpis indifferenter ſe habet reſpectu duorum angulorum adjacentium, idcirco eorum ſigna per vices uſurpanda ſunt: ſecundum quas conditiones hujuſmodi ſtruatur quæſtio:

$$\begin{aligned} a + e &= 2y & a &= ? \\ e + y &= 3 - a & e &= ? \\ y + a &= 4e & y &= ? \end{aligned}$$

Poſito autem ſtylum ſequenti foramini infigi, cuſpis ſtylaris in + angulare dirigetur, ſignaque lateralia + & — pariter reſpiciet. Proinde, ſi fert animus dextram inire ſemitam, juxta leges præmiſſas ſequens prodibit quæſtio:

$a + e$

$$a + e = ey \qquad a = ?$$
$$e - y = ay \qquad e = ?$$
$$y + a = ae \qquad y = ?$$

* Notandum autem primo, quod varietatem aliquam in ſignorum & ſpecierum combinationibus præſcriptæ leges admittant. Unde fit, quod cuſpide ſemitaque determinatis, diverſæ oriantur quæſtiones.

Secundo, quod etſi ad primæ literæ recurſum ſiſtendum eſſe ſupra ſtatuimus, lex tamen illa pro cujuſvis arbitrio mutari poſſit; ita ut progrediamur donec ſingulæ, *a*, *e*, *z*, *x*, obverſentur, vel aliqua ex iis bis, vel ad aliam quamcunque metam. Sed ad luſum properamus.

Primum itaque è luſoribus aliquis ad methodum jam traditam quæſtionem ſibi formet. Quod & cæteris deinceps iiſdem legibus faciendum eſt. Porro formatis ſingulorum quæſtionibus, ad ejus quæ ſorte obtigit ſolutionem ſe quiſque accingat. Faciat dein unuſquiſque fractionem, cujus numerator ſit numerus quantitatum in ſuo problemate quæſitarum, & nominator, numerus graduum ſive æquationum quas, dum ſolveretur quæſtio, chartis mandabat. Penes quem maxima ſit fractio, is vincat.

Proinde, ſiquando fugitivæ quantitates inhiantem eluſerint algebriſtam, is omni victoriæ ſpe excidiſſe cenſendus eſt. Neque id prorſus injuria, ſiquidem potius eligentis culpa quam infortunio accidat quæſtionem eſſe indeterminatam.

Quotieſcunque inter ludendum deveniatur ad æquationem affectam ſupra ordinem quadraticum, nihil opus erit exegeſi numeroſa aut con-

* *Vide Appendicem.*

ſtructione

ſtructione per parabolam, ſufficit ſi radix incognita mutata ſpecie pro cognita habeatur.

Peractis omnium quæſtionum ſolutionibus, quiſque proximi opus percurrat; ad quod Pellii margines conducant.

Quæ pignora & mulctas ſpectant, quiſquam ad libitum comminiſcatur: hæc enim aliis permitto.

Problemata quod ſpectat, illa quidem difficilia non ſunt, alioqui inepta forent ad luſum; ſed ea tamen, quorum ſolutio in ingens luſorum commodum ceſſerit, dum rectum tramitem inire ſtudent, dum longos conſequentiarum nexus animo recolunt, integramque analyſeos ſeriem breviſſimo conceptu claudere laborant.

Permitte jam, adoleſcens optime, ut alios pauliſper alloquar; tibi enim, quem ipſa trahit difficultas, nihil opus hortatore. Vos, adoleſcentes academici, compello, quibus ineſt ſagacitas, mentiſque vigor & acumen; triſtem verò in muſæo ſolitudinem, duramque eorum qui vulgo audiunt *Pumps*, vitam averſamini, ſatius inter congerrones, per jocum & luſum, ingenium prodere ducentes. Videtis quam merus luſus ſit algebra, & ſors locum habet, & ſcientia: quidni igitur ad tabulam luſoriam accedatis? Neque enim, quod in chartis, ſcacchis, dominis, &c. uſu venit, ut dum alii ludunt, alii oſcitanter adſtent, hic etiam metuatis. Nam quotcunque ludendi inceſſerit libido, iis omnibus ludere ſimulac ſtudere, adde & nonnullis, lucelli aliquid corradere fas eſt. Aſt aliquem audire mihi videor in hujuſmodi verba erumpentem: Itane vero nos decipi poſſe putas? non ii ſumus, quos ad difficillimam artem ſudore multo addiſcendum, oblata luſus ſpecie, ineſcare liceat. Reſpondeo, algebram eatenus eſſe difficilem quantum ad luſum requiritur: quod ſi tollas omnem difficultatem, tollitur ſimul recreatio omnis ac voluptas.

Siquidem ludi omnes totidem ſunt artes & ſcientiæ; nec aliud eſt inter cæteros & hunc noſtrum diſcrimen, quam quod illi præſens ſolummodo oblectamentum ſpectent; ex hoc vero, præter jucundiſſimum laborem, alii etiam iique uberrimi fructus percipiantur. Tantum autem abeſt quod hoc in luſus detrimentum cedat, ut is idcirco omnibus numeris abſolutus jure habeatur, juxta tritum illud poetæ,

Omne tulit punctum qui miſcuit utile dulci.

Sed quinam ſunt illi quos prædicas fructus? Hos ut enumerem, univerſa, quaqua patet, matheſis, arteſque omnes ac ſcientiæ, quas rem militarem civilem & philoſophicam promoventes complectitur, perluſtrandæ forent. Quippe per haſce omnes diffunditur mirifica algebræ vis. Eadem apud omnes ars magna, mirabilis, ſupremus cognitionis humanæ apex, univerſæ matheſeos nucleus & clavis, imo apud nonneminem ſcientiarum omnium fundamentum audit. Et ſane quam difficile eſſet algebræ limites aſſignare, cum philoſophiam etiam naturalem & medicinam jamdudum invaſit, inque dies diſſitiſſima quæque argumenta aggreditur. Ut alia taceam in *Actis Philoſoph.* N°. 257, de certitudine teſtimoniorum & traditionum humanarum algebraica extant theoremata. Et pro certo ſtatuendum eſt, ubicunque datur magis ac minus, ubicunque ratio aliqua aut proportio invenitur, ibi locum habere algebram.

Verum dixerit fortaſſe aliquis, ſe nec matheſin ipſam, nec res mathematice tractatas morari. Ut lubet: demus hoc voluntati cujuſpiam, demus ignorantiæ: nimirum ex ignorantia rerum præclariſſimarum, * *quæque vos à barbaris diſtinguunt*, contemptum proficiſci affirmare auſim. Eſtne vero quiſquam qui ingenium ſagax, intellectum capacem, judicium acre parvi faciat? Siquis uſque adeo rationis expers inveniatur, is demum matheſin ſpernat, quæ quanti ſit momenti ad optimos quoſque mentis habitus comparandos, apud omnes in confeſſo eſt.

* *Vide Tentamen Anglicum de hortis Epicuri, à* Gulielmo Temple *Equite Aurato conſcriptum.*

Verula-

Verulamius alicubi, in iis quæ de Augmentis ſcientiarum conſcripſit, analogiam quandam inter pilæ palmariæ luſum & matheſin notat. Nempe quemadmodum per illum, ultra voluptatem quæ primum intenditur, alia eaque potiora conſequamur, *viz.* corporis agilitatem & robur, promptumque oculorum motum: ſic diſciplinæ mathematicæ, præter fines ac uſus ſingulis proprios, illud etiam collaterale habent, quod mentem à ſenſibus abſtrahant, ingeniumque acuant & figant. Idem hoc tam olim veteres, quam hodie è modernis cordatiores quique agnoſcunt. Quod vero recentiorum algebra ad ingenium formandum imprimis conducat, inter alios oſtendunt *Carteſius*, & prolixe *Malbranchius* de inquirenda veritate, *Lib.* 6. *Part.* 1. *Cap.* 5. & *Part.* 2. *Cap.* 8. alibique paſſim. Et regulæ quidem quas hic in quæſtionum ſolutione obſervandas tradit, *Lib.* 6. *Part* 2. *Cap.* 1. quæque tam ſunt eximiæ, ut meliores angelum non fuiſſe daturum credat author quidam ingenioſus: illæ, inquam, regulæ angelicæ ex algebra deſumi videntur. At quid alios memorem, cum vir omni laude major, *Johannes Lockius*, qui ſingulos intellectus humani defectus, eorumque remedia, ſiquis alius, optime callebat, cum univerſæ matheſeos, tum præſertim algebræ ſtudium, omnibus ſupra plebem poſitis, tanquam rem infiniti uſus vehementer commendat? Vide inter opera ejus poſthuma, *Pag.* 30, 31, 32, *&c.* Tractatus de regimine intellectus: opus exiguum quidem illud & imperfectum, ſed quod vaſtis & elaboratis aliorum voluminibus jure quiſquam prætulerit. At vero autor magni nominis ad diſciplinas mathematicas acrem nimis meditationem, quæque homini generoſo & voluptatibus ſtudenti minus conveniat, requiri putat. Reſpondeo, ſuadente *Lockio*, fruſtra opponi diffidentis *Sant-evremontii* judicium. Deinde hic ineptus matheſeos judex merito habeatur, quippe qui, uti ex ejus vita & ſcriptis pluſquam veriſimile eſt, eam vix a limine ſalutarat. Si vero cortex durus videatur & exuccus, quid mirum? Sed ut dicam quod res eſt; præſtat ſingulos rem ipſam expertos propria ſequi judicia. Nec eſt cur quis ingentes difficultates ſibi

fingat, eo quod vox algebra neſcio quid aſperum ſonat & horrificum; artem enim, quantum ad ludum noſtrum requiritur, intra breve unius menſis ſpatium facilè quiſquam perdiſcat.

Expoſita demum luſus & conſilii noſtri ratione, lectorem mathematicum, ut tenues iſtas ſtudiorum meorum primitias candide accipiat, rogo, potiora forſan poſthac daturus. Impræſentiarum autem me alia diſtinent ſtudia quæ, arida ſatis & jejuna, ſuaviſſimam matheſin exceperunt. Tu interim, clariſſime adoleſcens, hanc nugarum rhapſodiam, tanquam aliquod mei erga te amoris ſymbolum, cape, & vale.

APPEN-

APPENDIX.

UT mentem noſtram quilibet pleniſſime aſſequatur, viſum eſt ſequentibus paginis omnem in quæſtionibus combinationum & ſpecierum varietatem, quam præfatæ ludendi conditiones patiantur, oculis ſubjicere.

Notandum autem, primo, quod ſequentes formulæ quoad modos combinandi & quantitatum ſpecies, non item omnes quoad numerum æquationum datarum, ad cuſpides reſpectivas pertinent: ſæpe enim plures quam tres quantitates inveſtigandæ erunt.

Secundo, quod ut omnes quæſtionum formulæ haberi poſſint, metæ diverſæ, prout fieri poſſe ſupra monuimus, ſtatuendæ ſunt: alioqui duæ tantum ex quatuor claſſibus ad cuſpidem quamcunque pertinebunt.

Primam dico cuſpidem quæ in + laterale dirigitur, ſecundam huic à dextris proximam, atque ita porro.

AD

AD

LECTOREM.

ISTA adoleſcentiæ noſtræ, obiter tantum proprioque marte ad quantulamcunque matheſeos ſcientiam olim enitentis, conamina in lucem protruſiſſe ſero aliquoties pœnituit. Quin & pœniteret etiamnum, niſi quod hinc nobile par ingeniorum in ſpem naſcentis ſæculi ſuccreſcentium una propalandi enaſcatur occaſio: neque enim nos aliunde rempublicam literariam demereri gloriamur. Atque hæc quidem ad temcritatis, &c. cenſuram, ut & invidiam, ſi quam mihi forte conflaverim, amoliendum dicta intelligantur.

Cuſpis

Cuſpis prima.

$a+e=b\times e \quad e-b \quad b\times y \quad y-b \quad e\times b \quad b-e \quad y\times b \quad b-y$
$e+y=b-y \quad y\times b \quad b-a \quad a\times b \quad y-b \quad b\times y \quad a-b \quad b\times a$
s $y+a=b\times a \quad a-b \quad b\times e \quad e-b \quad a\times b \quad b-a \quad e\times b \quad b-e$

$a+e=b\times e \quad e-b \quad b\times y \quad y-b \quad e\times b \quad b-e \quad y\times b \quad b-y$
$e+y=c-y \quad y\times c \quad c-a \quad a\times c \quad y-c \quad c\times y \quad a-c \quad c\times a$
d $y+a=d\times a \quad a-d \quad d\times e \quad e-d \quad a\times d \quad d-a \quad e\times d \quad d-e$

$a+e=2\times e \quad e-2 \quad 2\times y \quad y-2 \quad e\times 2 \quad 2-e \quad y\times 2 \quad 2-y$
$e+y=3-y \quad y\times 3 \quad 3-a \quad a\times 3 \quad y-3 \quad 3\times y \quad a-3 \quad 3\times a$
f $y+a=4\times a \quad a-4 \quad 4\times e \quad e-4 \quad a\times 4 \quad 4-a \quad e\times 4 \quad 4-e$

$a+e=e\times y \quad e-y \quad e\times y \quad y-e$
$e+y=y-a \quad y\times a \quad a-y \quad a\times y$
* $y+a=a+e \quad a-e \quad a\times e \quad e-a$

Cuſpis ſecunda.

$a+e=b\times e \quad b\times y$
$e+y=b\times y \quad b\times a$
s $y+a=b\times a \quad b\times e$

$a+e=b\times e \quad b\times y$
$e+y=c\times y \quad c\times a$
d $y+a=d\times a \quad d\times e$

$a+e=2\times e \quad 2\times y$
$e+y=3\times y \quad 3\times a$
f $y+a=4\times a \quad 4\times e$

$a+e=e\times y$
$e+y=y\times a$
* $y+a=a\times e$

Cuspis tertia.

	$a+e$	$a-e=e\times b$	$y\times b$
s	$e-y$	$e+y=y\times b$	$a\times b$
	$y+a$	$y-a=a\times b$	$e\times b$
	$a+e$	$a-e=e\times b$	$y\times b$
d	$e-y$	$e+y=y\times c$	$a\times c$
	$y+a$	$y-a=a\times d$	$e\times d$
	$a+e$	$a-e=e\times 2$	$y\times 2$
f	$e-y$	$e+y=y\times 3$	$a\times 3$
	$y+a$	$y-a=a\times 4$	$e\times 4$
	$a+e$	$a-e=e\times y$	
x	$e-y$	$e+y=y\times a$	
	$y+a$	$y-a=a\times e$	

Cuspis quarta.

	$a-e=b\times e$	$b\times y$
s	$e-y=b\times y$	$b\times a$
	$y-a=b\times a$	$b\times e$
	$a-e=b\times e$	$b\times y$
d	$e-y=c\times y$	$c\times a$
	$y-a=d\times a$	$d\times e$
	$a-e=2\times e$	$2\times y$
f	$e-y=3\times y$	$3\times a$
	$y-a=4\times a$	$4\times e$
	$a-e=e\times y$	
x	$e-y=y\times a$	
	$y-a=a\times e$	

Cuspis

Cuſpis quinta.

	$a-e=e\times b$	$b\div e$	$y\times b$	$b\div y$	$b\times e$	$e\div b$	$b\times y$	$y\div b$
s	$e-y=y\div b$	$b\times y$	$a\div b$	$b\times a$	$b\div y$	$y\times b$	$b\div a$	$a\times b$
	$y-a=a\times b$	$b\div a$	$e\times b$	$b\div e$	$b\times a$	$a\div b$	$b\times e$	$e\div b$
	$a-e=e\times b$	$b\div e$	$y\times b$	$b\div y$	$b\times e$	$e\div b$	$b\times y$	$y\div b$
d	$e-y=y\div c$	$c\times y$	$a\div c$	$c\div a$	$c\div y$	$y\times c$	$c\div a$	$a\times c$
	$y-a=a\times d$	$d\div a$	$e\times d$	$d\div e$	$d\times a$	$a\div d$	$d\times e$	$e\div d$
	$a-e=e\times 2$	$2\div e$	$y\times 2$	$2\div y$	$2\times e$	$e\div b$	$2\times y$	$y\div 2$
f	$e-y=y\div 3$	$3\times y$	$a\div 3$	$3\times a$	$3\div y$	$y\times c$	$3\div a$	$a\times 3$
	$y-a=a\times 4$	$4\div e$	$o\times 4$	$4\div e$	$4\times a$	$a\div d$	$4\times e$	$e\div 4$
	$a-e=e\times y$	$e\div y$	$e\times y$	$y\div e$				
x	$e-y=y\div a$	$y\times a$	$a\div y$	$a\times y$				
	$y-a=a\times e$	$a\div e$	$a\times e$	$e\div a$				

Cuſpis ſexta.

	$a-e=b\div e$	$b\div y$	$e\div b$	$y\div b$				
s	$e-y=b\div y$	$b\div a$	$y\div b$	$a\div b$				
	$y-a=b\div a$	$b\div e$	$a\div b$	$e\div b$				
	$a-e=b\div e$	$b\div y$	$e\div b$	$y\div b$				
d	$e-y=c\div y$	$c\div a$	$y\div e$	$a\div c$				
	$y-a=d\div a$	$d\div e$	$a\div d$	$e\div d$				
	$a-e=2\div e$	$2\div y$	$e\div 2$	$y\div 2$				
f	$e-y=3\div y$	$3\div a$	$y\div 3$	$a\div 3$				
	$y-a=4\div a$	$4\div e$	$a\div 4$	$e\div 4$				
	$a-e=e\div y$	$y\div e$						
x	$e-y=y\div a$	$a\div y$						
	$y-a=a\div e$	$e\div a$						

Cuſpis ſeptima.

	$a-e$	$a\times e=e\div b$	$b\div e$	$y\div b$	$b\div y$
s	$e\times y$	$e-y=y\div b$	$b\div y$	$a\div b$	$b\div a$
	$y-a$	$y\times a=a\div b$	$b\div a$	$e\div b$	$b\div e$
	$a-c$	$a\times e=e\div b$	$b\div e$	$y\div b$	$b\div y$
d	$e\times y$	$e-y=y\div c$	$c\div y$	$a\div c$	$c\div a$
	$y-a$	$y\times a=a\div d$	$d\div a$	$e\div d$	$d\div e$
	$a-e$	$a\times e=e\div 2$	$2\div e$	$y\div 2$	$2\div y$
f	$e+y$	$e-y=y\div 3$	$3\div y$	$a\div 3$	$3\div a$
	$y-a$	$y\times a=a\div 4$	$4\div a$	$e\div 4$	$4\div e$
	$a-e$	$a\times e=e\div y$	$y\div e$		
x	$e+y$	$e-y=y\div a$	$a\div y$		
	$y-a$	$y\times a=a\div e$	$e\div a$		

Cuſpis octava.

	$a\times e=e\div b$	$b\div e$	$y\div b$	$b\div y$	
s	$e\times y=y\div b$	$b\div y$	$a\div b$	$b\div a$	
	$y\times a=a\div b$	$b\div a$	$e\div b$	$b\div e$	
	$a\times e=e\div b$	$b\div e$	$y\div b$	$b\div y$	
d	$e\times y=y\div c$	$c\div y$	$a\div c$	$c\div a$	
	$y\times a=a\div d$	$d\div a$	$e\div d$	$d\div e$	
	$a\times e=e\div 2$	$2\div e$	$y\div 2$	$2\div y$	
f	$e\times y=y\div 3$	$3\div y$	$a\div 3$	$3\div a$	
	$y\times a=a\div 4$	$4\div a$	$e\div 4$	$4\div e$	
	$a\times e=e\div y$	$y\div e$			
x	$e\times y=y\div a$	$a\div y$			
	$y\times a=a\div e$	$e\div a$			

Cuſpis

Cuſpis nona.

	$a \times e = b + e$	$e \div b$	$b + y$	$y \div b$	$e + b$	$b \div e$	$y + b$	$b \div y$
s	$e \times y = b + y$	$y + b$	$b \div a$	$a + b$	$y \div b$	$b + y$	$a \div b$	$b + a$
	$y \times a = b + a$	$a \div b$	$b + e$	$e \div b$	$a + b$	$b \div a$	$e + b$	$b \div e$
	$a \times e = b + e$	$e \div b$	$b + y$	$y \div b$	$e + b$	$b \div e$	$y + b$	$b \div y$
d	$e \times y = c \div y$	$y + c$	$c \div a$	$a + c$	$y \div c$	$c + y$	$a \div c$	$c + a$
	$y \times a = d + a$	$a \div d$	$d + e$	$e \div d$	$a + d$	$d \div a$	$e + d$	$d \div e$
	$a \times e = 2 + e$	$e \div 2$	$2 + y$	$y \div 2$	$e + 2$	$2 \div e$	$y + 2$	$2 \div y$
f	$e \times y = 3 \div y$	$y + 3$	$3 \div a$	$a + 3$	$y \div 3$	$3 + y$	$a \div 3$	$3 + a$
	$y \times a = 4 + a$	$a \div 4$	$4 + e$	$e \div 4$	$a + 4$	$4 \div a$	$e + 4$	$4 \div e$

	$a \times e = e + y$	$e \div y$	$e + y$	$y \div e$
x	$e \times y = y \div a$	$y + a$	$a \div y$	$a + y$
	$y \times a = a + e$	$a \div e$	$a + e$	$e \div a$

Cuſpis decima.

	$a \times e = e + b$	$y + b$	
s	$e \times y = y + b$	$a + b$	
	$y \times a = a + b$	$e + b$	
	$a \times e = e + b$	$y + b$	
d	$e \times y = y + c$	$a + c$	
	$y \times a = a + d$	$e + d$	
	$a \times e = e + 2$	$y + 2$	
f	$e \times y = y + 3$	$a + 3$	
	$y \times a = a + 4$	$e + 4$	

	$a \times e = e + y$	
x	$e \times y = y + a$	
	$y \times a = a + e$	

Cuspis undecima.

$$
\begin{array}{llll}
 & a \times e & a \div e = e + b & y + b \\
s & e \div y & e \times y = y + b & a + b \\
 & y \times a & y \div a = a + b & e + b
\end{array}
$$

$$
\begin{array}{llll}
 & a \times e & a \div e = e + b & y + b \\
d & e \div y & e \times y = y + c & a + c \\
 & y \times a & y \div a = a + d & e + d
\end{array}
$$

$$
\begin{array}{llll}
 & a \times e & a \div e = e + 2 & y + 2 \\
f & e \div y & e \times y = y + 3 & a + 3 \\
 & y \times a & y \div a = a + 4 & e + 4
\end{array}
$$

$$
\begin{array}{llll}
 & a \times e & a \div e = e + y & \\
x & e \div y & e \times y = y + a & \\
 & y \times a & y \div a = a + e &
\end{array}
$$

Cuspis duodecima.

$$
\begin{array}{llll}
 & a \div e = b + e & b + y & \\
s & e \div y = b + y & b + a & \\
 & y \div a = b + a & b + e &
\end{array}
$$

$$
\begin{array}{llll}
 & a \div e = b + e & b + y & \\
d & e \div y = c + y & c + a & \\
 & y \div a = d + a & d + e &
\end{array}
$$

$$
\begin{array}{llll}
 & a \div e = 2 + e & 2 + y & \\
f & e \div y = 3 + y & 3 + a & \\
 & y \div a = 4 + e & 4 + e &
\end{array}
$$

$$
\begin{array}{llll}
 & a \div e = e + y & & \\
x & e \div y = y + a & & \\
 & y \div a = a + e & &
\end{array}
$$

Cuspis

Cuſpis decima tertia.

$a : e = e+b \quad b-e \quad y+b \quad b-y \quad b+e \quad e-b \quad b+y \quad y-b$
$s \quad e \div y = y-b \quad b+y \quad a-b \quad b+a \quad b-y \quad y+b \quad b-a \quad a+b$
$y \div a = a+b \quad b-a \quad e+b \quad b-e \quad b+a \quad a-b \quad b+e \quad e-b$

$a \div e = e+b \quad b-e \quad y+b \quad b-y \quad b+e \quad e-b \quad b+y \quad y-b$
$d \quad e \div y = y-c \quad c+y \quad a-c \quad c+a \quad c-y \quad y+c \quad c-a \quad a+c$
$y \div a = a+d \quad d-a \quad e+d \quad d-e \quad d+a \quad a-d \quad d+e \quad e-d$

$a \div e = e+2 \quad 2-e \quad y+2 \quad 2-y \quad 2+e \quad e-2 \quad 2+y \quad y-2$
$x \quad e \div y = y-3 \quad 3+y \quad a-3 \quad 3+a \quad 3-y \quad y+3 \quad 3-a \quad a+3$
$y \div a = a+4 \quad 4-a \quad e+4 \quad 4-e \quad 4+a \quad a-4 \quad 4+e \quad e-4$

$a \div e = e+y \quad e-y \quad e+y \quad y-e$
$x \quad e \div y = y-a \quad y+a \quad a-y \quad a+y$
$y \div a = a+e \quad a-e \quad a+e \quad e-a$

Cuſpis decima quarta.

$a \div e = b-e \quad b-y \quad e-b \quad y-b$
$s \quad e \div y = b-y \quad b-a \quad y-b \quad a-b$
$y \div a = b-a \quad b-e \quad a-b \quad e-b$

$a \div e = b-e \quad b-y \quad e-b \quad y-b$
$d \quad e \div y = c-y \quad c-a \quad y-c \quad a-c$
$y \div a = d-a \quad d-e \quad a-d \quad e-d$

$a \div e = 2-e \quad 2-y \quad e-2 \quad y-2$
$f \quad e \div y = 3-y \quad 3-a \quad y-3 \quad a-3$
$y \div a = 4-a \quad 4-e \quad a-4 \quad e-4$

$a \div e = e-y \quad y-e$
$x \quad e \div y = y-a \quad a-y$
$y \div a = a-e \quad e-a$

Cuſpis

Cuſpis decima quinta.

$a \div e \quad a + e = e - b \quad y - b \quad b - e \quad b - y$
$s \quad e + y \quad e \div y = y - b \quad a - b \quad b - y \quad b - a$
$y \div a \quad y + a = a - b \quad e - b \quad b - a \quad b - e$

$a \div e \quad a + e = e - b \quad y - b \quad b - e \quad b - y$
$d \quad e + y \quad e \div y = y - c \quad a - c \quad c - y \quad c - a$
$y \div a \quad y + a = a - d \quad e - d \quad d - a \quad d - e$

$a \div e \quad a + e = e - 2 \quad y - 2 \quad 2 - e \quad 2 - y$
$f \quad e + y \quad e \div y = y - 3 \quad a - 3 \quad 3 - y \quad 3 - a$
$y \div a \quad y + a = a - 4 \quad e - 4 \quad 4 - a \quad 4 - a$

$a \div e \quad a + e = e - y \quad y - e$
$x \quad e + y \quad e \div y = y - a \quad a - y$
$y \div a \quad y + a = a - e \quad e - a$

Cuſpis decima ſexta.

$a + e = e - b \quad y - b \quad b - e \quad b - y$
$s \quad a + y = y - b \quad a - b \quad b - y \quad b - a$
$y + a = a - b \quad e - b \quad b - a \quad b - e$

$a + e = e - b \quad y - b \quad b - e \quad b - y$
$d \quad e + y = y - c \quad a - c \quad c - y \quad c - a$
$y + a = a - d \quad e - d \quad d - a \quad d - e$

$a + e = e - 2 \quad y - 2 \quad 2 - e \quad 2 - y$
$f \quad e + y = y - 3 \quad a - 3 \quad 3 - y \quad 3 - a$
$y + a = a - 4 \quad e - 4 \quad 4 - a \quad 4 - e$

$a + e = e - y \quad y - e$
$x \quad e + y = y - a \quad a - y$
$y + a = a - e \quad e - a$

N. B.

N. B. Eſt & alia varietas in prioribus æquationum membris ubi ſignum analyticum reperitur, *viz.* ſi ſpecies tranſponamus. *E. g.* in cuſpide quarta adhibitis $\begin{Bmatrix} e-a \\ y-e \\ a-y \end{Bmatrix}$ in duodecima $\begin{Bmatrix} e \div a \\ y \div e \\ a \div y \end{Bmatrix}$ duplicabuntur quæſtiones.

☞ *Ne quis forte putet quæſtiones omnes in ludo noſtro poſſibiles a tabulis exhiberi, notandum eſt illas revera eſſe innumeras. Nam metæ infinities variari poterunt: ex his vero pendet numerus quantitatum in quovis problemate quæſitarum, qui proinde pro metarum diverſitate erit infinite variabilis; unde quæſtiones orientur innumeræ, in quarum tamen ſingulis non aliæ ſervandæ ſunt methodi pro ſignis, combinationibus, & ſpeciebus determinandis, quam quæ in ſolis quæſtionibus imparis cujuſvis præter unitatem numeri quantitatum quæſitarum, atque adeo in tabulis quas appoſuimus exhibeantur.*

DE

MOTU;

SIVE DE

MOTUS PRINCIPIO & NATURA,

ET DE

CAUSA COMMUNICATIONIS MOTUUM.

DE

MOTU;

SIVE

De motus principio & natura, et de cauſa communicationis motuum.

1. AD veritatem inveniendam præcipuum eſt caviſſe ne voces malè intellectæ nobis officiant: quod omnes fere monent philoſophi, pauci obſervant. Quanquam id quidem haud adeo difficile videtur, in rebus præſertim phyſicis tractandis, ubi locum habent ſenſus, experientia, & ratiocinium geometricum. Sepoſito igitur, quantum licet, omni præjudicio, tam a loquendi conſuetudine quam a philoſophorum auctoritate nato, ipſa rerum natura diligenter inſpicienda. Neque enim cujuſquam auctoritatem uſque adeo valere oportet, ut verba ejus & voces in pretio ſint, dummodo nihil clari & certi iis ſubeſſe comperiatur.

2. Motus contemplatio mirè torſit veterum philoſophorum mentes, unde natæ ſunt variæ opiniones ſupra modum difficiles, ne dicam abſurdæ, quæ quum jam fere in deſuetudinem abierint, haud merentur ut iis diſcutiendis nimio ſtudio immoremur. Apud recentiores autem & ſaniores hujus ævi philoſophos, ubi de motu agitur, vocabula haud pauca abſtractæ nimium & obſcuræ ſignificationis occurrunt, cujuſmodi ſunt *ſolicitatio gravitatis*, *conatus*, *vires mortuæ*, &c. quæ ſcriptis alioqui doc-

tiſſimis tenebras offundunt, ſententiiſque non minus a vero quam a ſenſu hominum communi abhorrentibus ortum præbent. Hæc vero neceſſe eſt ut, veritatis gratia, non alios refellendi ſtudio, accuratè diſcutiantur.

3. Solicitatio & niſus ſive conatus rebus ſolummodo animatis revera competunt. Cùm aliis rebus tribuuntur, ſenſu metaphorico accipiantur, neceſſe eſt. A metaphoris autem abſtinendum philoſopho. Porro ſecluſa omni tam animæ affectione quam corporis motione, nihil clari ac diſtincti iis vocibus ſignificari cuilibet conſtabit, qui modò rem ſeriò perpenderit.

4. Quamdiu corpora gravia a nobis ſuſtinentur, ſentimus in nobiſmet ipſis niſum, fatigationem, & moleſtiam. Percipimus etiam in gravibus cadentibus motum acceleratum verſus centrum telluris: ope ſenſuum præterea nihil. Ratione tamen colligitur cauſam eſſe aliquam vel principium horum phænomenôn; illud autem *gravitas* vulgo nuncupatur. Quoniam vero cauſa deſcenſus gravium cæca ſit & incognita, gravitas eâ acceptione proprie dici nequit qualitas ſenſibilis: eſt igitur qualitas occulta. Sed vix, & ne vix quidem, concipere licet quid ſit qualitas occulta, aut qua ratione qualitas ulla agere aut operari quidquam poſſit. Melius itaque foret, ſi, miſſa qualitate occulta, homines attenderent ſolummodo ad effectus ſenſibiles, vocibuſque abſtractis (quantumvis illæ ad differendum utiles ſint) in meditatione omiſſis, mens in particularibus & concretis, hoc eſt in ipſis rebus, defigeretur.

5. *Vis* ſimiliter corporibus tribuitur: uſurpatur autem vocabulum illud, tanquam ſignificaret qualitatem cognitam, diſtinctamque tam a motu, figura, omnique alia re ſenſibili, quam ab omni animalis affectione: id vero nihil aliud eſſe quàm qualitatem occultam rem acriùs rimanti conſtabit.

ſtabit. Niſus animalis & motus corporeus vulgo ſpectantur tanquam ſymptomata & menſuræ hujus qualitatis occultæ.

6. Patet igitur gravitatem aut vim fruſtra poni pro principio motus: nunquid enim principium illud clariùs cognoſci poteſt ex eo quod dicatur qualitas occulta? Quod ipſum occultum eſt, nihil explicat. Ut omittamus cauſam agentem incognitam rectius dici poſſe ſubſtantiam quàm qualitatem. Porro *vis*, *gravitas*, & iſtuſmodi voces ſæpius, nec ineptè, in concreto uſurpantur, ita ut connotent corpus motum, difficultatem reſiſtendi, *&c.* Ubi vero a philoſophis adhibentur ad ſignificandas naturas quaſdam ab hiſce omnibus præciſas & abſtractas, quæ nec ſenſibus ſubjiciuntur nec ulla mentis vi intelligi nec imaginatione effingi poſſunt, tum demum errores & confuſionem pariunt.

7. Multos autem in errorem ducit, quod voces generales & abſtractas in differendo utiles eſſe videant, nec tamen earum vim ſatis capiant. Partim vero a conſuetudine vulgari inventæ ſunt illæ ad ſermonem abbreviandum, partim a philoſophis ad docendum excogitatæ; non quod ad naturas rerum accommodatæ ſint, quæ quidem ſingulares & concretæ exiſtunt, ſed quod idoneæ ad tradendas diſciplinas, propterea quod faciant notiones vel ſaltem propoſitiones univerſales.

8. Vim corpoream eſſe aliquid conceptu facile plerumque exiſtimamus: ii tamen qui rem accuratiùs inſpexerunt in diverſa ſunt opinione, uti apparet ex mira verborum obſcuritate qua laborant, ubi illam explicare conantur. Toricellius ait vim & impetum eſſe res quaſdam abſtractas ſubtileſque, & quinteſſentias quæ includuntur in ſubſtantia corporea, tanquam in vaſe magico Circes *. Leibnitius item in natura vis explicanda

* La materia altro non e che un vaſo di Circe incantato, il quale ſerve per ricettacolo della forza & de momenti dell' impeto: la forza & l'impeti ſono aſtratti tanto ſottili, ſono quin-

canda hæc habet. *Vis activa, primitiva, quæ eſt* ἐντελέχεια ἡ πρώτη, *animæ vel formæ ſubſtantiali reſpondet.* Vid. *Acta erudit: Lipſ.* Uſque adeo neceſſe eſt ut vel ſummi viri, quamdiu abſtractionibus indulgent, voces nulla certa ſignificatione præditas & meras ſcholaſticorum umbras ſectentur. Alia ex neotericorum ſcriptis, nec pauca quidem ea, producere liceret, quibus abundè conſtaret, metaphyſicas abſtractiones non uſquequaque ceſſiſſe mechanicæ & experimentis, ſed negotium inane philoſophis etiamnum faceſſere.

9. Ex illo fonte derivantur varia abſurda, cujus generis eſt illud, *vim percuſſionis utcunque exiguæ eſſe infinitè magnam.* Quod ſane ſupponit, gravitatem eſſe qualitatem quandam realem ab aliis omnibus diverſam; & gravitationem eſſe quaſi actum hujus qualitatis a motu realiter diſtinctum; minima autem percuſſio producit effectum majorem quam maxima gravitatio ſine motu: illa ſcilicet motum aliquem edit, hæc nullum. Unde ſequitur, vim percuſſionis ratione infinita excedere vim gravitationis, hoc eſt, eſſe infinitè magnam. Videantur experimenta Galilæi, et quæ de definita vi percuſſionis ſcripſerunt Torricellius, Borellus, & alii.

10. Veruntamen fatendum eſt vim nullam per ſe immediate ſentiri, neque aliter quam per effectum cognoſci & menſurari: ſed vis mortuæ ſeu gravitationis ſimplicis, in corpore quieſcente ſubjecto nulla facta mutatione, effectus nullus eſt; percuſſionis autem, effectus aliquis. Quoniam ergo vires ſunt effectibus proportionales, concludere licet vim mortuam eſſe nullam: neque tamen propterea vim percuſſionis eſſe infinitam: non enim oportet quantitatem ullam poſitivam habere pro infinita, propterea quod ratione infinita ſuperet quantitatem nullam ſive nihil.

quinteſſenze tanto ſpiritoſe, che in altre ampolle non ſi poſſono rachiudere, fuor che nell' intima corpulenza dè ſolidi naturali. Vid. Lezioni Academiche.

11. Vis

11. Vis gravitationis a momento ſecerni nequit; momentum autem ſine celeritate nullum eſt, quum ſit moles in celeritatem ducta: porro celeritas ſine motu intelligi non poteſt; ergo nec vis gravitationis. Deinde vis nulla niſi per actionem innoteſcit, & per eandem menſuratur; actionem autem corporis a motu præſcindere non poſſumus: ergo quamdiu corpus grave plumbi ſubjecti vel chordæ figuram mutat, tamdiu movetur; ubi vero quieſcit, nihil agit, vel, quod idem eſt, agere prohibetur. Breviter, voces iſtæ *vis mortua* & *gravitatio*, etſi per abſtractionem metaphyſicam aliquid ſignificare ſupponuntur diverſum a movente, moto, motu & quiete, revera tamen id totum nihil eſt.

12. Siquis diceret pondus appenſum vel impoſitum agere in chordam, quoniam impedit quominus ſe reſtituat vi elaſtica; dico, pari ratione corpus quodvis inferum agere in ſuperius incumbens, quoniam illud deſcendere prohibet: dici vero non poteſt actio corporis, quod prohibeat aliud corpus exiſtere in eo loco quem occupat.

13. Preſſionem corporis gravitantis quandoque ſentimus. Verum ſenſio iſta moleſta oritur ex motu corporis iſtius gravis fibris nerviſque noſtri corporis communicato, & eorundem ſitum immutante; adeoque percuſſioni accepta referri debet. In hiſce rebus multis & gravibus præjudiciis laboramus, ſed illa acri atque iterata meditatione ſubigenda ſunt, vel potius penitùs averruncanda.

14. Quo probetur quantitatem ullam eſſe infinitam, oſtendi oportet partem aliquam finitam homogeneam in eâ infinities contineri. Sed vis mortua ſe habet ad vim percuſſionis, non ut pars ad totum, ſed ut punctum ad lineam, juxta ipſos vis infinitæ percuſſionis auctores. Multa in hanc rem adjicere liceret, ſed vereor ne prolixus ſim.

15. Ex

15. Ex principiis præmiſſis lites inſignes ſolvi poſſunt, quæ viros doctos multum exercuerunt. Hujus rei exemplum ſit controverſia illa de proportione virium. Una pars dum concedit, momenta, motus, impetus, data mole, eſſe ſimpliciter ut velocitates, affirmat vires eſſe ut quadrata velocitatum. Hanc autem ſententiam ſupponere vim corporis diſtingui a momento, motu, & impetu, eaque ſuppoſitione ſublata corruere, nemo non videt.

16. Quo clarius adhuc appareat, confuſionem quandam miram per abſtractiones metaphyſicas in doctrinam de motu introductam eſſe, videamus quantum interſit inter notiones virorum celebrium de vi & impetu. Leibnitius impetum cum motu confundit. Juxta Newtonum impetus revera idem eſt cum vi inertiæ. Borellus aſſerit impetum non aliud eſſe quam gradum velocitatis. Alii impetum & conatum inter ſe differre, alii non differre volunt. Plerique vim motricem motui proportionalem intelligunt. Nonnulli aliam aliquam vim præter motricem, & diverſimodè menſurandam, utpote per quadrata velocitatum in moles, intelligere præ ſe ferunt. Sed infinitum eſſet hæc proſequi.

17. *Vis*, *gravitas*, *attractio*, & hujuſmodi voces, utiles ſunt ad ratiocinia & computationes de motu & corporibus motis; ſed non ad intelligendam ſimplicem ipſius motus naturam, vel ad qualitates totidem diſtinctas deſignandas. Attractionem certe quod attinet, patet illam ab Newtono adhiberi, non tanquam qualitatem veram & phyſicam, ſed ſolummodo ut hypotheſin mathematicam. Quin & Leibnitius, niſum elementarem ſeu ſolicitationem ab impetu diſtinguens, fatetur illa entia non re ipſa inveniri in rerum natura, ſed abſtractione facienda eſſe.

18. Similis ratio eſt compoſitionis & reſolutionis virium quarumcunque directarum in quaſcunque obliquas, per diagonalem & latera parallelogrammi. Hæc mechanicæ & computationi inſerviunt: ſed aliud eſt computationi

putationi & demonſtrationibus mathematicis inſervire, aliud rerum naturam exhibere.

19. Ex recentioribus multi ſunt in eâ opinione, ut putent motum neque deſtrui nec de novo gigni, ſed eandem ſemper motus quantitatem permanere. Ariſtoteles etiam dubium illud olim propoſuit, utrum motus factus ſit & corruptus, an verò ab æterno? Phyſ. l. 8. Quod vero motus ſenſibilis pereat, patet ſenſibus: illi autem eundem impetum, niſum, aut ſummam virium eandem manere velle videntur. Unde affirmat Borellus, vim in percuſſione non imminui, ſed expandi; impetus etiam contrarios ſuſcipi & retineri in eodem corpore. Item Leibnitius niſum ubique & ſemper eſſe in materia, & ubi non patet ſenſibus, ratione intelligi contendit. Hæc autem nimis abſtracta eſſe & obſcura, ejuſdemque ferè generis cum formis ſubſtantialibus & entelechiis, fatendum.

20. Quotquot ad explicandam motus cauſam atque originem vel principio hylarchico, vel naturæ indigentia, vel appetitu, aut denique inſtinctu naturali utuntur, dixiſſe aliquid potius quam cogitaſſe cenſendi ſunt. Neque ab hiſce multùm abſunt qui ſuppoſuerint, * *partes terræ eſſe ſe moventes, aut etiam ſpiritus iis implantatos ad inſtar formæ*, ut aſſignent cauſam accelerationis gravium cadentium: aut qui dixerit, † *in corpore præter ſolidam extenſionem debere etiam poni aliquid unde virium conſideratio oriatur.* Siquidem hi omnes vel nihil particulare & determinatum enuntiant; vel, ſi quid ſit, tam difficile crit illud explicare, quam id ipſum cujus explicandi cauſâ adducitur.

21. Fruſtra ad naturam illuſtrandam adhibentur ea quæ nec ſenſibus patent, nec ratione intelligi poſſunt. Videndum ergo quid ſenſus, quid experientia, quid demum ratio iis innixa ſuadeat. Duo ſunt ſumma rerum genera, corpus & anima. Rem extenſam, ſolidam, mobilem, figu-

* Borellus. † Leibnitius.

ratam, aliiſque qualitatibus quæ ſenſibus occurrunt præditam, ope ſenſuum; rem vero ſentientem, percipientem, intelligentem, conſcientiâ quâdam internâ cognovimus. Porro res iſtas planè inter ſe diverſas eſſe, longeque heterogeneas, cernimus. Loquor autem de rebus cognitis: de incognitis enim differere nil juvat.

22. Totum id quod novimus, cui nomen *corpus* indidimus, nihil in ſe continet quod motûs principium ſeu cauſa efficiens eſſe poſſit: etenim impenetrabilitas, extenſio, figura nullam includunt vel connotant potentiam producendi motum; quinimo è contrario non modo illas verum etiam alias, quotquot ſint, corporis qualitates ſigillatim percurrentes, videbimus omnes eſſe revera paſſivas, nihilque iis activum ineſſe, quod ullo modo intelligi poſſit tanquam fons & principium motus. Gravitatem quod attinet, voce illa nihil cognitum & ab ipſo effectu ſenſibili, cujus cauſa quæritur, diverſum ſignificari jam ante oſtendimus. Et ſanè quando corpus grave dicimus, nihil aliud intelligimus, niſi quod feratur deorſum, de cauſâ hujus effectus ſenſibilis nihil omnino cogitantes.

23. De corpore itaque audacter pronunciare licet, utpote de re comperta, quod non ſit principium motûs. Quod ſi quiſquam, præter ſolidam extenſionem ejuſque modificationes, vocem *corpus* qualitatem etiam occultam, virtutem, formam, eſſentiam complecti ſua ſignificatione contendat; licet quidem illi inutili negotio ſine ideis diſputare, & nominibus nihil diſtinctè exprimentibus abuti. Cæterùm ſanior philoſophandi ratio videtur ab notionibus abſtractis & generalibus (ſi modo notiones dici debent quæ intelligi nequeunt) quantum fieri poteſt abſtinuiſſe.

24. Quicquid continetur in idea corporis novimus: quod vero novimus in corpore id non eſſe principium motûs conſtat. Qui præterea aliquid incognitum in corpore, cujus ideam nullam habent, comminiſcuntur,

cuntur, quod motûs principium dicant, ii revera nihil aliud quam principium motûs eſſe incognitum dicunt. Sed hujuſmodi ſubtilitatibus diutius immorari piget.

25. Præter res corporeas, alterum eſt genus rerum cogitantium: in iis autem potentiam ineſſe corpora movendi, propria experientia didicimus, quandoquidem anima noſtra pro lubitu poſſit ciere & ſiſtere membrorum motus, quacunque tandem ratione id fiat. Hoc certè conſtat, corpora moveri ad nutum animæ, eamque proinde haud ineptè dici poſſe principium motus; particulare quidem & ſubordinatum, quodque ipſum dependeat a primo & univerſali principio.

26. Corpora gravia feruntur deorſum, etſi nullo impulſu apparente agitata; non tamen exiſtimandum propterea in iis contineri principium motus: cujus rei hanc rationem aſſignat Ariſtoteles, *Gravia & levia*, inquit, *non moventur a ſeipſis; id enim vitale eſſet, & ſe ſiſtere poſſent.* Gravia omnia unâ eâdemque certa & conſtanti lege centrum telluris petunt, neque in ipſis animadvertitur principium vel facultas ulla motum iſtum ſiſtendi, minuendi, vel, niſi pro rata proportione, augendi, aut denique ullo modo immutandi: habent adeò ſe paſſivè. Porro idem, ſtrictè & accuratè loquendo, dicendum de corporibus percuſſivis. Corpora iſta quamdiu moventur, ut & in ipſo percuſſionis momento, ſe gerunt paſſivè, perinde ſcilicet atque cum quieſcunt. Corpus iners tam agit quam corpus motum, ſi res ad verum exigatur: id quod agnoſcit Newtonus, ubi ait, vim inertiæ eſſe eandem cum impetu. Corpus autem iners & quietum nihil agit, ergo nec motum.

27. Revera corpus æquè perſeverat in utrovis ſtatu, vel motûs vel quietis. Iſta vero perſeverantia non magis dicenda eſt actio corporis, quam exiſtentia ejuſdem actio diceretur. Perſeverantia nihil aliud eſt quam continuatio in eodem modo exiſtendi, quæ propriè dici actio non poteſt.

Cæterùm reſiſtentiam, quam experimur in ſiſtendo corpore moto, ejus actionem eſſe fingimus vana ſpecie deluſi. Revera enim iſta reſiſtentia quam ſentimus, paſſio eſt in nobis, neque arguit corpus agere, ſed nos pati: conſtat utique nos idem paſſuros fuiſſe, ſive corpus illud a ſe moveatur, ſive ab alio principio impellatur.

28. Actio & reactio dicuntur eſſe in corporibus: nec incommodè ad demonſtrationes mechanicas. Sed cavendum, ne propterea ſupponamus virtutem aliquam realem, quæ motûs cauſa ſive principium ſit, eſſe in iis. Etenim voces illæ eodem modo intelligendæ ſunt ac vox *attractio*: & quemadmodum hæc eſt hypotheſis ſolummodo mathematica, non autem qualitas phyſica; idem etiam de illis intelligi debet, & ob eandem rationem. Nam ſicut veritas & uſus theorematum de mutua corporum attractione in philoſophia mechanica ſtabiles manent, utpote unicè fundati in motu corporum, ſive motus iſte cauſari ſupponatur per actionem corporum ſe mutuo attrahentium, ſive per actionem agentis alicujus a corporibus diverſi impellentis & moderantis corpora; pari ratione, quæcunque tradita ſunt de regulis & legibus motuum, ſimul ac theoremata inde deducta, manent inconcuſſa, dum modo concedantur effectus ſenſibilis, & ratiocinia iis innixa; ſive ſupponamus actionem ipſam, aut vim horum effectuum cauſatricem, eſſe in corpore, ſive in agente incorporeo.

29. Auferantur ex idea corporis extenſio, ſoliditas, figura, remanebit nihil. Sed qualitates iſtæ ſunt ad motum indifferentes, nec in ſe quidquam habent, quod motus principium dici poſſit. Hoc ex ipſis ideis noſtris perſpicuum eſt. Si igitur voce *corpus* ſignificatur id quod concipimus, planè conſtat inde non peti poſſe principium motus: pars ſcilicet nulla aut attributum illius cauſa efficiens vera eſt, quæ motum producat. Vocem autem proferre, & nihil concipere, id demum indignum eſſet philoſopho.

30. Datur

30. Datur res cogitans, activa, quam principium motûs esse in nobis experimur. Hanc *animam*, *mentem*, *spiritum* dicimus. Datur etiam res extensa, iners, impenetrabilis, mobilis, quæ a priori toto cœlo differt, novumque genus constituit. Quantum interfit inter res cogitantes & extensas, primus omnium deprehendens Anaxagoras vir longè sapientissimus, asserebat mentem nihil habere cum corporibus commune, id quod constat ex primo libro Aristotelis de anima. Ex neotericis idem optimè animadvertit Cartesius. Ab eo alii rem satis claram vocibus obscuris impeditam ac difficilem reddiderunt.

31. Ex dictis manifestum est eos qui vim activam, actionem, motus principium, in corporibus revera inesse affirmant, sententiam nulla experientia fundatam amplecti, eamque terminis obscuris & generalibus adstruere, nec quid sibi velint satis intelligere. E contrario, qui mentem esse principium motus volunt, sententiam propria experientia munitam proferunt, hominumque omni ævo doctissimorum suffragiis comprobatam.

32. Primus Anaxagoras τὸν νοῦν introduxit, qui motum inerti materiæ imprimeret: quam quidem sententiam probat etiam Aristoteles, pluribusque confirmat, apertè pronuncians primum movens esse immobile, indivisibile, & nullam habens magnitudinem. Dicere autem, omne motivum esse mobile, rectè animadvertit idem esse ac siquis diceret, omne ædificativum esse ædificabile, Physic. l. 8. Plato insuper in Timæo tradit machinam hanc corpoream, seu mundum visibilem agitari & animari à mente, quæ sensum omnem fugiat. Quinetiam hodie philosophi Cartesiani principium motuum naturalium Deum agnoscunt. Et Newtonus passim nec obscurè innuit, non solummodo motum ab initio a numine profectum esse, verum adhuc systema mundanum ab eodem actu moveri. Hoc sacris literis consonum est: hoc scholasticorum calculo comprobatur. Nam etsi Peripatetici naturam tradant esse principium motûs & quietis, interpretantur

pretantur tamen naturam naturantem eſſe Deum. Intelligunt nimirum corpora omnia ſyſtematis hujuſce mundani à mente præpotenti juxta certam & conſtantem rationem moveri.

33. Cæterùm qui principium vitale corporibus tribuunt, obſcurum aliquid & rebus parum conveniens fingunt. Quid enim aliud eſt vitali principio præditum eſſe quam vivere? aut vivere quam ſe movere, ſiſtere, & ſtatum ſuum mutare? Philoſophi autem hujus ſæculi doctiſſimi pro principio indubitato ponunt, omne corpus perſeverare in ſtatu ſuo, vel quietis vel motûs uniformis in directum, niſi quatenus aliunde cogitur ſtatum illum mutare: è contrario, in anima ſentimus eſſe facultatem tam ſtatum ſuum quam aliarum rerum mutandi; id quod propriè dicitur vitale, animamque a corporibus longe diſcriminat.

34. Motum & quietem in corporibus recentiores conſiderant velut duos ſtatus exiſtendi, in quorum utrovis corpus omne ſua natura iners permaneret, nulla vi externa urgente. Unde colligere licet, eandem eſſe cauſam motûs & quietis, quæ eſt exiſtentiæ corporum. Neque enim quærenda videtur alia cauſa exiſtentiæ corporis ſucceſſivæ in diverſis partibus ſpatii, quam illa unde derivatur exiſtentia ejuſdem corporis ſucceſſiva in diverſis partibus temporis. De Deo autem Opt. Max. rerum omnium conditore & conſervatore tractare, & qua ratione res cunctæ a ſummo & vero Ente pendeant demonſtrare, quamvis pars ſit ſcientiæ humanæ præcellentiſſima, ſpectat tamen potius ad philoſophiam primam ſeu metaphyſicam & theologiam, quam ad philoſophiam naturalem, quæ hodie fere omnis continetur in experimentis & mechanicâ. Itaque cognitionem de Deo vel ſupponit philoſophia naturalis, vel mutuatur ab aliqua ſcientia ſuperiori. Quanquam veriſſimum ſit, naturæ inveſtigationem ſcientiis altioribus argumenta egregia ad ſapientiam, bonitatem, & potentiam Dei illuſtrandam & probandam undequaque ſubminiſtrare.

35. Quod

35. Quod hæc minus intelligantur, in cauſa eſt, cur nonnulli immerito repudient phyſicæ principia mathematica, eo ſcilicet nomine quod illa cauſas rerum efficientes non aſſignant: quum tamen revera ad phyſicam aut mechanicam ſpectet regulas ſolummodo, non cauſas efficientes, impulſionum attractionumve, & ut verbo dicam, motuum leges tradere; ex iis vero poſitis phænomenôn particularium ſolutionem, non autem cauſam efficientem aſſignare.

36. Multum intererit conſideraſſe quid propriè ſit principium, & quo ſenſu intelligenda ſit vox illa apud philoſophos. Cauſa quidem vera efficiens & conſervatrix rerum omnium jure optimo appellatur fons & principium earundem. Principia vero philoſophiæ experimentalis propriè dicenda ſunt fundamenta quibus illa innititur, ſeu fontes unde derivatur, (non dico exiſtentia, ſed) cognitio rerum corporearum, ſenſus utiqne & experientia. Similiter, in philoſophia mechanica, principia dicenda ſunt, in quibus fundatur & continetur univerſa diſciplina, leges illæ motuum primariæ, quæ experimentis comprobatæ, ratiocinio etiam excultæ ſunt & redditæ univerſales. Hæ motuum leges commodè dicuntnr principia, quoniam ab iis tam theoremata mechanica generalia quam particulares τῶν Φαινομένων explicationes derivantur.

37. Tum nimirum dici poteſt quidpiam explicari mechanicè, cum reducitur ad iſta principia ſimpliciſſima & univerſaliſſima, & per accuratum ratiocinium, cum iis conſentaneum & connexum eſſe oſtenditur. Nam inventis ſemel naturæ legibus, deinceps monſtrandum eſt philoſophio, ex conſtanti harum legum obſervatione, hoc eſt, ex iis principiis phænomenon quodvis neceſſario conſequi: id quod eſt phænomena explicare & ſolvere, cauſamque, id eſt rationem cur fiant, aſſignare.

38. Mens humana gaudet ſcientiam ſuam extendere & dilatare. Ad hoc autem notiones & propoſitiones generales efformandæ ſunt, in quibus

bus quodam modo continentur propoſitiones & cognitiones particulares, quæ tum demum intelligi creduntur cum ex primis illis continuo nexu deducuntur. Hoc geometris notiſſimum eſt. In mechanica etiam præmittuntur notiones, hoc eſt definitiones, & enunciationes de motu primæ & generales, ex quibus poſtmodum methodo mathematica concluſiones magis remotæ & minus generales colliguntur. Et ſicut per applicationem theorematum geometricorum, corporum particularium magnitudines menſurantur; ita etiam per applicationem theorematum mechanices univerſalium, ſyſtematis mundani partium quarumvis motus, & phænomena inde pendentia, innoteſcunt & determinantur: ad quem ſcopum unicè collineandum phyſico.

39. Et quemadmodum geometræ diſciplinæ cauſâ multa comminiſcuntur, quæ nec ipſi deſcribere poſſunt, nec in rerum natura invenire; ſimili prorſus ratione mechanicus voces quaſdam abſtractas & generales adhibet, fingitque in corporibus vim, actionem, attractionem, ſolicitationem, &c. quæ ad theorias & enunciationes, ut & computationes de motu apprime utiles ſunt, etiamſi in ipsa rerum veritate & corporibus actu exiſtentibus fruſtra quærerentur, non minus quam quæ a geometris per abſtractionem mathematicam finguntur.

40. Revera ope ſenſuum nil niſi effectus ſeu qualitates ſenſibiles, & res corporeas omnino paſſivas, ſive in motu ſint ſive in quiete, percipimus: ratioque & experientia activum nihil præter mentem aut animam eſſe ſuadet. Quicquid ultra fingitur, id ejuſdem generis eſſe cum aliis hypotheſibus & abſtractionibus mathematicis exiſtimandum: quod penitus animo infigere oportet. Hoc ni fiat, facilè in obſcuram ſcholaſticorum ſubtilitatem, quæ per tot ſæcula, tanquam dira quædam peſtis, philoſophiam corrupit, relabi poſſumus.

41. Principia

41. Principia mechanica legeſque motuum aut naturæ univerſales, ſæculo ultimo feliciter inventæ, & ſubſidio geometriæ tractatæ & applicatæ, miram lucem in philoſophiam intulerunt. Principia vero metaphyſica cauſæque reales efficientes motûs & exiſtentiæ corporum attributorumve corporeorum nullo modo ad mechanicam aut experimenta pertinent, neque eis lucem dare poſſunt, niſi quatenus, velut præcognita inſerviant ad limites phyſicæ præfiniendos, eaque ratione ad tollendas difficultates quæſtioneſque peregrinas.

42. Qui à ſpiritibus motûs principium petunt, ii vel rem corpoream vel incorpoream voce *ſpiritus* intelligunt: ſi rem corpoream, quantumvis tenuem, tamen redit difficultas: ſi incorpoream, quantumvis id verum ſit, attamen ad phyſicam non propriè pertinet. Quod ſi quis philoſophiam naturalem ultra limites experimentorum & mechanicæ extenderit, ita ut rerum etiam incorporearum, & inextenſarum cognitionem complectatur; latior quidem illa vocis acceptio tractationem de anima, mente, ſeu principio vitali admittit. Cæterùm commodius erit, juxta uſum jam ferè receptum, ita diſtinguere inter ſcientias, ut ſingulæ propriis circumſcribantur cancellis, & philoſophus naturalis totus ſit in experimentis, legibuſque motuum, & principiis mechanicis, indeque depromptis ratiociniis; quidquid autem de aliis rebus protulerit, id ſuperiori alicui ſcientiæ acceptum referat. Etenim ex cognitis naturæ legibus pulcherrimæ theoriæ, praxes etiam mechanicæ ad vitam utiles conſequuntur. Ex cognitione autem ipſius naturæ auctoris conſiderationes, longe præſtantiſſimæ quidem illæ, ſed metaphyſicæ, theologicæ, morales oriuntur.

43. De principiis hactenus: nunc dicendum de natura motus. Atque is quidem, cum ſenſibus clare percipiatur, non tam natura ſua, quam doctis philoſophorum commentis obſcuratus eſt. Motus nunquam in ſenſus noſtros incurrit ſine mole corporea, ſpatio, & tempore. Sunt tamen qui motum, tanquam ideam quandam ſimplicem & abſtractam, at-

que ab omnibus aliis rebus ſejunctam, contemplari ſtudent. Verùm idea illa tenuiſſima & ſubtiliſſima intellectûs aciem eludit: id quod quilibet ſecum meditando experiri poteſt. Hinc naſcuntur magnæ difficultates de natura motus, & definitiones, ipſa re quam illuſtrare debent longe obſcuriores. Hujuſmodi ſunt definitiones illæ Ariſtotelis & Scholaſticorum, qui motum dicunt eſſe *actum mobilis quatenus eſt mobile*, *vel actum entis in potentia quatenus in potentia.* Hujuſmodi etiam eſt illud viri inter recentiores celebris, qui aſſerit *nihil in motu eſſe reale præter momentaneum illud quod in vi ad mutationem nitente conſtitui debet.* Porro conſtat, horum & ſimilium definitionum auctores in animo habuiſſe abſtractam motus naturam, ſecluſa omni temporis & ſpatii conſideratione, explicare: ſed qua ratione abſtracta illa motus quinteſſentia (ut ita dicam) intelligi poſſit non video.

44. Neque hoc contenti, ulterius pergunt, parteſque ipſius motus a ſe invicem dividunt & ſecernunt, quarum ideas diſtinctas, tanquam entium revera diſtinctorum, efformare conantur. Etenim ſunt qui motionem a motu diſtinguant, illam velut inſtantaneum motus elementum ſpectantes. Velocitatem inſuper, conatum, vim, impetum totidem res eſſentia diverſas eſſe volunt, quarum quæque per propriam atque ab aliis omnibus ſegregatam & abſtractam ideam intellectui objiciatur. Sed in hiſce rebus diſcutiendis, ſtantibus iis quæ ſupra diſſeruimus, non eſt cur diutius immoremur.

45. Multi etiam per *tranſitum* motum definiunt, obliti ſcilicet tranſitum ipſum ſine motu intelligi non poſſe, & per motum definiri oportere. Veriſſimum adeo eſt definitiones, ſicut nonnullis rebus lucem, ita viciſſim aliis tenebras afferre. Et profecto, quaſcumque res ſenſu percipimus, eas clariores aut notiores definiendo efficere vix quiſquam potuerit. Cujus rei vana ſpe allecti res faciles difficillimas reddiderunt philoſophi, menteſque ſuas difficultatibus, quas ut plurimum ipſi peperiſſent, implicavere.

Ex

Ex hocce definiendi, ſimulac abſtrahendi ſtudio, multæ tam de motu quam de aliis rebus natæ ſubtiliſſimæ quæſtiones, eædemque nullius utilitatis, hominum ingenia fruſtra torſerunt, adeo ut Ariſtoteles ultro & ſæpius fateatur motum eſſe *actum quendam cognitu difficilem*, & nonnulli ex veteribus uſque eo nugis exercitati deveniebant, ut motum omnino eſſe negarent.

46. Sed hujuſmodi minutiis diſtineri piget. Satis ſit fontes ſolutionum indicaſſe: ad quos etiam illud adjungere libet: quod ea quæ de infinita diviſione temporis & ſpatii in matheſi traduntur, ob congenitam rerum naturam paradoxa & theorias ſpinoſas (quales ſunt illæ omnes in quibus agitur de infinito) in ſpeculationes de motu intulerunt. Quidquid autem hujus generis ſit, id omne motus commune habet cum ſpatio & tempore, vel potius ad ea refert acceptum.

47. Et quemadmodum ex una parte nimia abſtractio ſeu diviſio rerum verè inſeparabilium, ita ab altera parte compoſitio ſeu potius confuſio rerum diverſiſſimarum motus naturam perplexam reddidit. Uſitatum enim eſt motum cum cauſa motus efficiente confundere. Unde accidit ut motus ſit quaſi biformis, unam faciem ſenſibus obviam, alteram caliginoſa nocte obvolutam habens. Inde obſcuritas & confuſio, & varia de motu paradoxa originem trahunt, dum effectui perperam tribuitur id quod revera cauſæ ſolummodo competit.

48. Hinc oritur opinio illa, eandem ſemper motus quantitatem conſervari; quod, niſi intelligatur de vi & potentia cauſæ, ſive cauſa illa dicatur natura, ſive νῦς, vel quodcunque tandem agens ſit, falſum eſſe cuivis facile conſtabit. Ariſtoteles quidem l. 8. phyſicorum, ubi quærit *utrum motus factus ſit & corruptus, an vero ab æterno tanquam vita immortalis inſit rebus omnibus*, vitale principium potius, quam effectum externum, ſive mutationem loci intellexiſſe videtur.

49. Hinc etiam eſt, quod multi ſuſpicantur motum non eſſe meram paſſionem in corporibus. Quod ſi intelligamus id quod in motu corporis ſenſibus objicitur, quin omnino paſſivum ſit nemo dubitare poteſt. Ecquid enim in ſe habet ſucceſſiva corporis exiſtentia in diverſis locis, quod actionem referat, aut aliud ſit quam nudus & iners effectus?

50. Peripatetici, qui dicunt motum eſſe actum unum utriuſque, moventis & moti, non ſatis diſcriminant cauſam ab effectu. Similiter, qui niſum aut conatum in motu fingunt, aut idem corpus ſimul in contrarias partes ferri putant, eâdem idearum confuſione, eâdem vocum ambiguitate ludificari videntur.

51. Juvat multum, ſicut in aliis omnibus, ita in ſcientia de motu accuratam diligentiam adhibere, tam ad aliorum conceptus intelligendos quam ad ſuos enunciandos: in qua re niſi peccatum eſſet, vix credo in diſputationem trahi potuiſſe, utrùm corpus indifferens ſit ad motum & ad quietem, necne. Quoniam enim experientiâ conſtat, eſſe legem naturæ primariam, ut corpus perinde perſeveret in *ſtatu motus ac quietis, quamdiu aliunde nihil accidat ad ſtatum iſtum mutandum*; et propterea vim inertiæ ſub diverſo reſpectu eſſe vel reſiſtentiam, vel impetum, colligitur: hoc ſenſu profectò corpus dici poteſt ſua natura indifferens ad motum vel quietem. Nimirum tam difficile eſt quietem in corpus motum, quam motum in quieſcens inducere: cum vero corpus pariter conſervet ſtatum utrumvis, quidni dicatur ad utrumvis ſe habere indifferenter?

52. Peripatetici pro varietate mutationum, quas res aliqua ſubire poteſt, varia motus genera diſtinguebant. Hodie de motu agentes intelligunt ſolummodo motum localem. Motus autem localis intelligi nequit niſi ſimul intelligatur quid ſit *locus*: is vero a neotericis definitur *pars ſpatii quam corpus occupat*; unde dividitur in relativum & abſolutum pro ratione ſpatii. Diſtinguunt enim inter ſpatium abſolutum ſive verum, ac relativum

relativum ſive apparens. Volunt ſcilicet dari ſpatium undequaque immenſum, immobile, inſenſibile, corpora univerſa permeans & continens, quod vocant ſpatium abſolutum. Spatium autem a corporibus comprehenſum vel definitum, ſenſibuſque adeo ſubjectum, dicitur ſpatium relativum, apparens, vulgare.

53. Fingamus itaque corpora cuncta deſtrui, & in nihilum redigi. Quod reliquum eſt vocant ſpatium abſolutum, omni relatione quæ a ſitu & diſtantiis corporum oriebatur, ſimul cum ipſis corporibus, ſublatâ. Porro ſpatium illud eſt infinitum, immobile, indiviſibile, inſenſibile, ſine relatione & ſine diſtinctione. Hoc eſt, omnia ejus attributa ſunt privativa vel negativa: videtur igitur eſſe merum nihil. Parit ſolummodo difficultatem aliquam quòd extenſum ſit. Extenſio autem eſt qualitas poſitiva. Verùm qualis tandem extenſio eſt illa, quæ nec dividi poteſt, nec menſurari, cujus nullam partem, nec ſenſu percipere, nec imaginatione depingere poſſumus? Etenim nihil in imaginationem cadit, quod, ex natura rei, non poſſibile eſt ut ſenſu percipiatur; ſiquidem imaginatio nihil aliud eſt quam facultas repreſentatrix rerum ſenſibilium, vel actu exiſtentium, vel ſaltem poſſibilium. Fugit inſuper intellectum purum, quum facultas illa verſetur tantum circa res ſpirituales & inextenſas, cujuſmodi ſunt mentes noſtræ, earumque habitus, paſſiones, virtutes, & ſimilia. Ex ſpatio igitur abſoluto auferamus modò vocabula, & nihil remanebit in ſenſu, imaginatione, aut intellectu: nihil aliud ergo iis deſignatur, quam pura privatio aut negatio, hoc eſt, merum nihil.

54. Confitendum omnino eſt nos circa hanc rem graviſſimis præjudiciis teneri, a quibus ut liberemur, omnis animi vis exerenda. Etenim multi, tantum abeſt quod ſpatium abſolutum pro nihilo ducant, ut rem eſſe ex omnibus (Deo excepto) unicam exiſtiment, quæ annihilari non poſſit: ſtatuantque illud ſuapte natura neceſſariò exiſtere, æternumque eſſe & increatum, atque adeo attributorum divinorum particeps. Verum enimvero

enimvero quum certiſſimum ſit, res omnes, quas nominibus deſignamus, per qualitates aut relationes, vel aliqua ſaltem ex parte, cognoſci, (ineptum enim foret vocabulis uti quibus cogniti nihil, nihil notionis, ideæ vel conceptus ſubjiceretur) inquiramus diligenter, utrum formare liceat ideam ullam ſpatii illius puri, realis, abſoluti, quod poſt omnium corporum annihilationem perſeveret exiſtere. Ideam porro talem paulo acrius intuens, reperio ideam eſſe nihili puriſſimam, ſi modo idea appellanda ſit. Hoc ipſe ſumma adhibita diligentia expertus ſum: hoc alios pari adhibita diligentia experturos reor.

55. Decipere nos nonnunquam ſolet, quod aliis omnibus corporibus imaginatione ſublatis, noſtrum tamen manere ſupponimus. Quo ſuppoſito, motum membrorum ab omni parte liberrimum imaginamur. Motus autem ſine ſpatio concipi non poteſt. Nihilominus ſi rem attento animo recolamus, conſtabit primo concipi ſpatium relativum partibus noſtri corporis definitum: 2°. movendi membra poteſtatem liberrimam nullo obſtaculo retuſam: & præter hæc duo nihil. Falſo tamen credimus tertium aliquod, ſpatium videlicit immenſum, realiter exiſtere, quod liberam poteſtatem nobis faciat movendi corpus noſtrum: ad hoc enim requiritur abſentia ſolummodo aliorum corporum. Quam abſentiam, ſive privationem corporum, nihil eſſe poſitivum fateamur neceſſe eſt *.

56. Cæterum haſce res niſi quis libero & acri examine perſpexerit, verba & voces parum valent. Meditanti vero, & rationes ſecum reputanti, ni fallor, manifeſtum erit, quæcunque de ſpatio puro & abſoluto prædicantur, ea omnia de nihilo prædicari poſſe. Qua ratione mens humana facillimè liberatur a magnis difficultatibus, ſimulque ab ea abſurditate tribuendi exiſtentiam neceſſariam ulli rei præterquam ſoli Deo optimo maximo.

* Vide quæ contra ſpatium abſolutum differuntur in libro de principiis cognitionis humanæ, idiomate anglicano decem abhinc annis edito.

57. In

57. In proclivi eſſet ſententiam noſtram argumentis a poſteriori (ut loquuntur) ductis confirmare, quæſtiones de ſpatio abſoluto proponendo; exempli gratia, utrum ſit ſubſtantia vel accidens? utrum creatum vel increatum? & abſurditates ex utravis parte conſequentes demonſtrando. Sed brevitati conſulendum. Illud tamen omitti non debet, quod ſententiam hancce Democritus olim calculo ſuo comprobavit, uti auctor eſt Ariſtoteles l. 1. Phyſ. ubi hæc habet: *Democritus ſolidum & inane ponit principia, quarum aliud quidem ut quod eſt, aliud ut quod non eſt, eſſe dicit.* Scrupulum ſi forte injiciat, quod diſtinctio illa inter ſpatium abſolutum & relativum a magni nominis philoſophis uſurpetur, eique quaſi fundamento inædificentur multa præclara theoremata, ſcrupulum iſtum vanum eſſe, ex iis quæ ſecutura ſunt, apparebit.

58. Ex præmiſſis patet, non convenire, ut definiamus locum verum corporis eſſe partem ſpatii abſoluti quam occupat corpus, motumque verum ſeu abſolutum eſſe mutationem loci veri & abſoluti. Siquidem omnis locus eſt relativus, ut & omnis motus. Veruntamen ut hoc clarius appareat, animadvertendum eſt, motum nullum intelligi poſſe ſine determinatione aliqua ſeu directione, quæ quidem intelligi nequit, niſi præter corpus motum, noſtrum etiam corpus, aut aliud aliquod, ſimul intelligatur exiſtere. Nam ſurſum, deorſum, ſiniſtrorſum, dextrorſum, omneſque plagæ & regiones in relatione aliqua fundantur, & neceſſariò corpus a moto diverſum connotant & ſupponunt. Adeo ut, ſi reliquis corporibus in nihilum redactis, globus, exempli gratia, unicus exiſtere ſupponatur; in illo motus nullus concipi poſſit: uſque adeo neceſſe eſt, ut detur aliud corpus, cujus ſitu motus determinari intelligatur. Hujus ſententiæ veritas clariſſime elucebit, modò corporum omnium tam noſtri quam aliorum, præter globum iſtum unicum, annihilationem recte ſuppoſuerimus.

59. Conci-

59. Concipiantur porro duo globi, & præterea nil corporeum, exiſtere. Concipiantur deinde vires quomodocunque applicari: quicquid tandem per applicationem virium intelligamus, motus circularis duorum globorum circa commune centrum nequit per imaginationem concipi. Supponamus deinde cœlum fixarum creari: ſubito ex concepto appulſu globorum ad diverſas cœli iſtius partes motus concipietur. Scilicet cum motus natura ſua ſit relativus, concipi non potuit priuſquam darentur corpora correlata. Quemadmodum nec ulla relatio alia ſine correlatis concipi poteſt.

60. Ad motum circularem quod attinet, putant multi, creſcente motu vero circulari, corpus neceſſario magis ſemper magiſque ab axe niti. Hoc autem ex eo provenit, quod, cum motus circularis ſpectari poſſit tanquam in omni momento à duabus directionibus ortum trahens, una ſecundum radium, altera ſecundum tangentem; ſi in hac ultima tantùm directione impetus augeatur, tum a centro recedet corpus motum, orbita vero deſinet eſſe circularis. Quod ſi æqualiter augeantur vires in utraque directione, manebit motus circularis, ſed acceleratus conatu, qui non magis arguet vires recedendi ab axe, quam accedendi ad eundem, auctas eſſe. Dicendum igitur, aquam in ſitula circumactam aſcendere ad latera vaſis, propterea quod, applicatis novis viribus in directione tangentis ad quamvis particulam aquæ, eodem inſtanti non applicentur novæ vires æquales centripetæ. Ex quo experimento nullo modo ſequitur, motum abſolutum circularem per vires recedendi ab axe motus neceſſariò dignoſci. Porrò qua ratione intelligendæ ſunt voces iſtæ, *vires corporum & conatus*, ex præmiſſis ſatis ſuperque innoteſcit.

61. Quo modo curva conſiderari poteſt tanquam conſtans ex rectis infinitis, etiamſi revera ex illis non conſtet, ſed quòd ea hypotheſis ad geometriam utilis ſit, eodem modo motus circularis ſpectari poteſt tanquam a directionibus

directionibus rectilineis infinitis ortum ducens, quæ ſuppoſitio utilis eſt in philoſophia mechanica. Non tamen ideo affirmandum, impoſſibile eſſe, ut centrum gravitatis corporis cujuſvis ſucceſſive exiſtat in ſingulis punctis peripheriæ circularis, nulla ratione habita directionis ullius rectilineæ, ſive in tangente ſive in radio.

62. Haud omittendum eſt, motum lapidis in fundâ, aut aquæ in ſitulâ circumactâ, dici non poſſe motum vere circularem, juxta mentem eorum qui per partes ſpatii abſoluti definiunt loca vera corporum; cum ſit mire compoſitus ex motibus non ſolum ſitulæ vel fundæ, ſed etiam telluris diurno circa proprium axem, menſtruo circa commune centrum gravitatis terræ & lunæ, & annuo circa ſolem: et propterea particula quævis lapidis vel aquæ deſcribat lineam a circulari longe abhorrentem. Neque revera eſt, qui creditur, conatus axifugus, quoniam non reſpicit unum aliquem axem ratione ſpatii abſoluti, ſuppoſito quod detur tale ſpatium: proinde non video quomodo appellari poſſit conatus unicus, cui motus vere circularis tanquam proprio & adæquato effectui reſpondet.

63. Motus nullus dignoſci poteſt, aut menſurari, niſi per res ſenſibiles. Cum ergo ſpatium abſolutum nullo modo in ſenſus incurrat, neceſſe eſt ut inutile prorſus ſit ad diſtinctionem motuum. Præterea determinatio ſive directio motui eſſentialis eſt, illa vero in relatione conſiſtit. Ergo impoſſibile eſt ut motus abſolutus concipiatur.

64. Porrò quoniam pro diverſitate loci relativi varius ſit motus ejuſdem corporis, quinimo uno reſpectu moveri, altero quieſcere dici quidpiam poſſit; ad determinandum motum verum & quietem veram, quo ſcilicet tollatur ambiguitas, & conſulatur mechanicæ philoſophorum, qui ſyſtema rerum latiùs contemplantur, ſatis fuerit ſpatium

relativum fixarum cœlo, tanquam quieſcente ſpectato, concluſum adhibere, loco ſpatii abſoluti. Motus autem & quies tali ſpatio relativo definiti, commode adhiberi poſſunt loco abſolutorum, qui ab illis nullo ſymptomate diſcerni poſſunt. Etenim imprimantur utcunque vires, ſint quicunque conatus, concedamus motum diſtingui per actiones in corpora exercitas; nunquam tamen inde ſequetur, dari ſpatium illud & locum abſolutum, ejuſque mutationem eſſe locum verum.

65. Leges motuum, effectuſque, & theoremata eorundem proportiones & calculos continentia, pro diverſis viarum figuris, accelerationibus itidem & directionibus diverſis, mediiſque plus minuſve reſiſtentibus, hæc omnia conſtant ſine calculatione motus abſoluti. Uti vel ex eo patet quod, quum ſecundum illorum principia qui motum abſolutum inducunt, nullo ſymptomate ſcire liceat, utrum integra rerum compages quieſcat, an moveatur uniformiter in directum, perſpicuum ſit motum abſolutum nullius corporis cognoſci poſſe.

66. Ex dictis patet ad veram motus naturam perſpiciendam ſummopere juvaturum, 1°. Diſtinguere inter hypotheſes mathematicas & naturas rerum: 2°. Cavere ab abſtractionibus: 3°. Conſiderare motum tanquam aliquid ſenſibile, vel ſaltem imaginabile; menſuriſque relativis eſſe contentos. Quæ ſi fecerimus, ſimul clariſſima quæque philoſophiæ mechanicæ theoremata, quibus referantur naturæ receſſus, mundique ſyſtema calculis humanis ſubjicitur, manebunt intemerata; & motus contemplatio a mille minutiis, ſubtilitatibus, ideiſque abſtractis libera evadet. Atque hæc de natura motûs dicta ſufficiant.

67. Reſtat, ut diſſeramus de cauſa communicationis motuum. Eſſe autem vim impreſſam in corpus mobile cauſam motus in eo, plerique exiſtimant.

exiſtimant. Veruntamen illos non aſſignare cauſam motus cognitam, & à corpore motuque diſtinctam, ex præmiſſis conſtat. Pater inſuper vim non eſſe rem certam & determinatam, ex eo quod viri ſummi de illa multum diverſa, immo contraria, proferant, ſalva tamen in conſequentiis veritate. Siquidem Newtonus ait vim impreſſam conſiſtere in actione ſola, eſſeque actionem exercitam in corpus ad ſtatum ejus mutandum, nec poſt actionem manere. Torricellius cumulum quendam ſive aggregatum virium impreſſarum per percuſſionem in corpus mobile recipi, ibidemque manere atque impetum conſtituere contendit. Idem fere Borellus aliique prædicant. At vero, tametſi inter ſe pugnare videantur Newtonus et Torricellius, nihilominus, dum ſinguli ſibi conſentanea proferunt, res ſatis commode ab utriſque explicatur. Quippe vires omnes corporibus attributæ tam ſunt hypotheſes mathematicæ quam vires attractivæ in planetis & ſole. Cæterum entia mathematica in rerum natura ſtabilem eſſentiam non habent: pendent autem à notione definientis: unde eadem res diverſimode explicari poteſt.

68. Statuamus motum novum in corpore percuſſo conſervari, ſive per vim inſitam, qua corpus quodlibet perſeverat in ſtatu ſuo vel motus vel quietis uniformis in directum; ſive per vim impreſſam, durante percuſſione in corpus percuſſum receptam ibidemque permanentem; idem erit quoad rem, differentia exiſtente in nominibus tantum. Similiter, ubi mobile percutiens perdit, & percuſſum acquirit motum, parum refert diſputare, utrum motus acquiſitus ſit idem numero cum motu perdito, ducit enim in minutias metaphyſicas & prorſus nominales de identitate. Itaque ſive dicamus motum tranſire a percutiente in percuſſum, ſive in percuſſo motum de novo generari, deſtrui autem in percutiente, res eodem recidit. Utrobique intelligitur unum corpus motum perdere, alterum acquirere, & præterea nihil.

 69. Mentem,

69. Mentem, quæ agitat & continet univerſam hancce molem corpoream, eſtque cauſa vera efficiens motus, eandem eſſe, proprie & ſtricte loquendo, cauſam communicationis ejuſdem haud negaverim. In philoſophia tamen phyſica, cauſas & ſolutiones phænomenôn à principiis mechanicis petere oportet. Phyſice igitur res explicatur non aſſignando ejus cauſam vere agentem & incorpoream, ſed demonſtrando ejus connexionem cum principiis mechanicis: cujuſmodi eſt illud, *actionem & reactionem eſſe ſemper contrarias & æquales*, à quo, tanquam fonte & principio primario, eruuntur regulæ de motuum communicatione, quæ a neotericis, magno ſcientiarum bono, jam ante repertæ ſunt & demonſtratæ.

70. Nobis ſatis fuerit, ſi innuamus principium illud alio modo declarari potuiſſe. Nam ſi vera rerum natura potius quam abſtracta matheſis ſpectetur, videbitur rectius dici, in attractione vel percuſſione paſſionem corporum, quam actionem, eſſe utrobique æqualem. Exempli gratia, lapis fune equo alligatus tantum trahitur verſus equum, quantum equus verſus lapidem: corpus etiam motum in aliud quieſcens impactum, patitur eandem mutationem cum corpore quieſcente. Et quoad effectum realem, percutiens eſt item percuſſum, percuſſumque percutiens. Mutatio autem illa eſt utrobique, tam in corpore equi quam in lapide, tam in moto quam in quieſcente, paſſio mera. Eſſe autem vim, virtutem, aut actionem corpoream talium effectuum vere & proprie cauſatricem non conſtat. Corpus motum in quieſcens impingitur; loquimur tamen activè, dicentes illud hoc impellere: nec abſurdè in mechanicis, ubi ideæ mathematicæ potius quam veræ rerum naturæ ſpectantur.

71. In phyſica, ſenſus & experientia, quæ ad effectus apparentes ſolummodo pertingunt, locum habent; in mechanica, notiones abſtractæ mathematicorum

mathematicorum admittuntur. In philoſophia prima, ſeu metaphyſica, agitur de rebus incorporeis, de cauſis, veritate, & exiſtentia rerum. Phyſicus ſeries ſive ſucceſſiones rerum ſenſibilium contemplatur, quibus legibus connectuntur, & quo ordine, quid præcedit tanquam cauſa, quid ſequitur tanquam effectus animadvertens. Atque hac ratione dicimus corpus motum eſſe cauſam motûs in altero, vel ei motum imprimere, trahere etiam, aut impellere. Quo ſenſu cauſæ ſecundæ corporeæ intelligi debent, nullâ ratione habitâ veræ ſedis virium, vel potentiarum actricum, aut cauſæ realis cui inſunt. Porro dici poſſunt cauſæ vel principia mechanica, ultra corpus, figuram, motum, etiam axiomata ſcientiæ mechanicæ primaria, tanquam cauſæ conſequentium ſpectata.

72. Cauſæ vere activæ meditatione tantum & ratiocinio è tenebris erui quibus involvuntur poſſunt, & aliquatenus cognoſci. Spectat autem ad philoſophiam primam, ſeu metaphyſicam, de iis agere. Quod ſi cuique ſcientiæ provincia ſua tribuatur, limites aſſignentur, principia & objecta accurate diſtinguantur, quæ ad ſingulas pertinent, tractare licuerit majore, cum facilitate, tum perſpicuitate.

THE

ANALYST:

OR A

DISCOURSE

ADDRESSED TO AN

Infidel MATHEMATICIAN:

WHEREIN

It is examined whether the Object, Principles, and Inferences of the modern Analyſis are more diſtinctly conceived, or more evidently deduced, than Religious Myſteries and Points of Faith.

THE

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XXXI. *Velocities not to be abſtracted from time and ſpace: nor their proportions to be inveſtigated or conſidered excluſively of time and ſpace.*

XXXII. *Difficult and obſcure points conſtitute the principles of the modern Analyſis, and are the foundation on which it is built.*

XXXIII. *The rational faculties whether improved by ſuch obſcure Analytics.*

XXXIV. *By what inconceivable ſteps finite lines are found proportional to fluxions. Mathematical infidels ſtrain at a gnat and ſwallow a camel.*

XXXV. *Fluxions of infiniteſimals not to be avoided on the received principles. Nice abſtractions and geometrical metaphyſics.*

XXXVI. *Velocities of naſcent or evaneſcent quantities, whether in reality underſtood and ſignified by finite lines and ſpecies?*

XXXVII. *Signs or exponents obvious; but fluxions themſelves not ſo.*

XXXVIII. *Fluxions, whether the velocities with which infiniteſimal differences are generated?*

XXXIX. *Fluxions of fluxions or ſecond fluxions, whether to be conceived as velocities of velocities, or rather as velocities of the ſecond naſcent increments?*

XL. *Fluxions conſidered, ſometimes in one ſenſe, ſometimes in another; one while in themſelves, another in their exponents: hence confuſion and obſcurity.*

XLI. *Iſochronal increments, whether finite or naſcent, proportional to their reſpective velocities.*

XLII. *Time ſuppoſed to be divided into moments: increments generated in thoſe moments: and velocities proportional to thoſe increments.*

XLIII. *Fluxions, ſecond, third, fourth,* &c. *what they are, how obtained, and how repreſented. What idea of velocity in a moment of time and point of ſpace.*

XLIV. *Fluxions of all orders inconceivable.*

XLV. *Signs or exponents confounded with the fluxions.*

XLVI. *Series of expreſſions or of notes eaſily contrived. Whether a ſeries of mere velocities, or of mere naſcent increments correſponding thereunto, be as eaſily conceived?*

XLVII. *Celerities diſmiſſed, and inſtead thereof ordinates and areas introduced. Analogies and expreſſions uſeful in the modern quadratures, may yet be uſeleſs for enabling us to conceive fluxions. No right to apply the rules without knowledge of the principles.*

XLVIII. *Metaphyſics of modern Analyſts moſt incomprehenſible.*

XLIX. *Analyſts employed about notional ſhadowy entities. Their logics as exceptionable as their metaphyſics.*

L. *Occaſion of this addreſs. Concluſion. Queries.*

THE

THE

ANALYST.

I. THOUGH I am a ſtranger to your perſon, yet I am not, Sir, a ſtranger to the reputation you have acquired in that branch of learning which hath been your peculiar ſtudy; nor to the authority that you therefore aſſume in things foreign to your profeſſion; nor to the abuſe that you, and too many more of the like character, are known to make of ſuch undue authority, to the miſleading of unwary perſons in matters of the higheſt concernment, and whereof your mathematical knowledge can by no means qualify you to be a competent judge. Equity indeed and good ſenſe would incline one to diſregard the judgment of men, in points which they have not conſidered or examined. But ſeveral who make the loudeſt claim to thoſe qualities do nevertheleſs the very thing they would ſeem to deſpiſe, clothing themſelves in the livery of other men's opinions, and putting on a general deference for the judgment of you, gentlemen, who are preſumed to be of all men the greateſt maſters of reaſon, to be moſt converſant about diſtinct ideas, and never to take things upon truſt, but always clearly to ſee your way, as men whoſe conſtant employment is the deducing truth by the juſteſt inference from the moſt evident principles. With this bias on their minds, they ſubmit to your deciſions where you have no right to decide. And that this is one ſhort way of making infidels, I am credibly informed.

II. Whereas

II. Whereas then it is ſuppoſed, that you apprehend more diſtinctly, conſider more cloſely, infer more juſtly, conclude more accurately than other men, and that you are therefore leſs religious becauſe more judicious, I ſhall claim the privilege of a Free-Thinker; and take the liberty to inquire into the object, principles, and method of demonſtration admitted by the mathematicians of the preſent age, with the ſame freedom that you preſume to treat the principles and myſteries of religion; to the end, that all men may ſee what right you have to lead, or what encouragement others have to follow you. It hath been an old remark, that geometry is an excellent logic. And it muſt be owned, that when the definitions are clear; when the poſtulata cannot be refuſed, nor the axioms denied; when from the diſtinct contemplation and compariſon of figures, their properties are derived, by a perpetual well-connected chain of conſequences, the objects being ſtill kept in view, and the attention ever fixed upon them; there is acquired an habit of reaſoning, cloſe and exact and methodical: which habit ſtrengthens and ſharpens the mind, and being transferred to other ſubjects, is of general uſe in the inquiry after truth. But how far this is the caſe of our geometrical Analyſts, it may be worth while to conſider.

III. The method of Fluxions is the general key, by help whereof the modern mathematicians unlock the ſecrets of geometry, and conſequently of nature. And as it is that which hath enabled them ſo remarkably to outgo the ancients in diſcovering theorems and ſolving problems, the exerciſe and application thereof is become the main, if not ſole, employment of all thoſe who in this age paſs for profound geometers. But whether this method be clear or obſcure, conſiſtent or repugnant, demonſtrative or precarious, as I ſhall inquire with the utmoſt impartiality, ſo I ſubmit my inquiry to your own judgment, and that of every candid reader. Lines are ſuppoſed to be generated

rated * by the motion of points, planes by the motion of lines, and ſolids by the motion of planes. And whereas quantities generated in equal times are greater or leſſer according to the greater or leſſer velocity wherewith they increaſe and are generated, a method hath been found to determine quantities from the velocities of their generating motions. And ſuch velocities are called fluxions: and the quantities generated are called flowing quantities. Theſe fluxions are ſaid to be nearly as the increments of the flowing quantities, generated in the leaſt equal particles of time; and to be accurately in the firſt proportion of the naſcent, or in the laſt of the evaneſcent increments. Sometimes, inſtead of velocities, the momentaneous increments or decrements of undetermined flowing quantities are conſidered, under the appellation of moments.

IV. By moments we are not to underſtand finite particles. Theſe are ſaid not to be moments, but quantities generated from moments, which laſt are only the naſcent principles of finite quantities. It is ſaid, that the minuteſt errors are not to be neglected in mathematics: that the fluxions are celerities, not proportional to the finite increments though ever ſo ſmall; but only to the moments or naſcent increments, whereof the proportion alone, and not the magnitude, is conſidered. And of the aforeſaid fluxions there be other fluxions, which fluxions of fluxions are called ſecond fluxions. And the fluxions of theſe ſecond fluxions are called third fluxions: and ſo on, fourth, fifth, ſixth, &c. *ad infinitum.* Now as our ſenſe is ſtrained and puzzled with the perception of objects extremely minute, even ſo the imagination, which faculty derives from ſenſe, is very much ſtrained and puzzled to frame clear ideas of the leaſt particles of time, or the leaſt increments generated therein: and much more ſo to comprehend the moments, or thoſe increments of the flowing quantities in *ſtatu naſcenti*,

* Introd. ad quadraturam curvarum.

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in their very firſt origin or beginning to exiſt, before they become finite particles. And it ſeems ſtill more difficult to conceive the abſtracted velocities of ſuch naſcent imperfect entities. But the velocities of the velocities, the ſecond, third, fourth and fifth velocities, &c. exceed, if I miſtake not, all human underſtanding. The further the mind analyſeth and purſueth theſe fugitive ideas, the more it is loſt and bewildered; the objects, at firſt fleeting and minute, ſoon vaniſhing out of ſight. Certainly, in any ſenſe, a ſecond or third fluxion ſeems an obſcure myſtery. The incipient celerity of an incipient celerity, the naſcent augment of a naſcent augment, *i. e.* of a thing which hath no magnitude; take it in what light you pleaſe, the clear conception of it will, if I miſtake not, be found impoſſible: whether it be ſo or no I appeal to the trial of every thinking reader. And if a ſecond fluxion be inconceivable, what are we to think of third, fourth, fifth fluxions, and ſo onward without end?

V. The foreign mathematicians are ſuppoſed by ſome, even of our own, to proceed in a manner leſs accurate perhaps and geometrical, yet more intelligible. Inſtead of flowing quantities and their fluxions, they conſider the variable finite quantities, as increaſing or diminiſhing by the continual addition or ſubduction of infinitely ſmall quantities. Inſtead of the velocities wherewith increments are generated, they conſider the increments or decrements themſelves, which they call differences, and which are ſuppoſed to be infinitely ſmall. The difference of a line is an infinitely little line; of a plane an infinitely little plane. They ſuppoſe finite quantities to conſiſt of parts infinitely little, and curves to be polygons, whereof the ſides are infinitely little, which by the angles they make one with another determine the curvity of the line. Now to conceive a quantity infinitely ſmall, that is, infinitely leſs than any ſenſible or imaginable quantity, or any the leaſt finite magnitude, is, I confeſs, above my capacity. But to conceive a part of ſuch infinitely ſmall quantity,

quantity, that ſhall be ſtill infinitely leſs than it, and conſequently though multiplied infinitely ſhall never equal the minuteſt finite quantity, is, I ſuſpect, an infinite difficulty to any man whatſoever; and will be allowed ſuch by thoſe who candidly ſay what they think; provided they really think and reflect, and do not take things upon truſt.

VI. And yet in the *calculus differentialis*, which method ſerves to all the ſame intents and ends with that of fluxions, our modern analyſts are not content to conſider only the differences of finite quantities: they alſo conſider the differences of thoſe differences, and the differences of the differences of the firſt differences. And ſo on *ad infinitum*. That is, they conſider quantities infinitely leſs than the leaſt diſcernible quantity; and others infinitely leſs than thoſe infinitely ſmall ones; and ſtill others infinitely leſs than the preceding infiniteſimals, and ſo on without end or limit. Inſomuch that we are to admit an infinite ſucceſſion of infiniteſimals, each infinitely leſs than the foregoing, and infinitely greater than the following. As there are firſt, ſecond, third, fourth, fifth, &c. fluxions, ſo there are differences, firſt, ſecond, third, fourth, &c. in an infinite progreſſion towards nothing, which you ſtill approach and never arrive at. And (which is moſt ſtrange) although you ſhould take a million of millions of theſe infiniteſimal, each whereof is ſuppoſed infinitely greater than ſome other real magnitude, and add them to the leaſt given quantity, it ſhall be never the bigger. For this is one of the modeſt *poſtulata* of our modern mathematicians, and is a corner-ſtone or ground-work of their ſpeculations.

VII. All theſe points, I ſay, are ſuppoſed and believed by certain rigorous exactors of evidence in religion, men who pretend to believe no further than they can ſee. That men, who have been converſant only about clear points, ſhould with difficulty admit obſcure ones might not ſeem altogether unaccountable. But he who can digeſt a ſecond or

third fluxion, a ſecond or third difference, need not, methinks, be ſqueamiſh about any point in divinity. There is a natural preſumption that mens faculties are made alike. It is on this ſuppoſition that they attempt to argue and convince one another. What, therefore, ſhall appear evidently impoſſible and repugnant to one, may be preſumed the ſame to another. But with what appearance of reaſon ſhall any man preſume to ſay, that myſteries may not be objects of faith, at the ſame time that he himſelf admits ſuch obſcure myſteries to be the object of ſcience?

VIII. It muſt indeed be acknowledged, the modern mathematicians do not conſider theſe points as myſteries, but as clearly conceived and maſtered by their comprehenſive minds. They ſcruple not to ſay, that by the help of theſe new analytics they can penetrate into infinity itſelf: that they can even extend their views beyond infinity: that their art comprehends not only infinite, but infinite of infinite (as they expreſs it) or an infinity of infinites. But, notwithſtanding all theſe aſſertions and pretenſions, it may be juſtly queſtioned whether, as other men in other inquiries are often deceived by words or terms, ſo they likewiſe are not wonderfully deceived and deluded by their own peculiar ſigns, ſymbols, or ſpecies. Nothing is eaſier than to deviſe expreſſions or notations for fluxions and infiniteſimals of the firſt, ſecond, third, fourth, and ſubſequent orders, proceeding in the ſame regular form without end or limit $\dot{x}. \ddot{x}. \dddot{x}. \ddddot{x}.$ &c. or *dx. ddx. dddx. ddddx. &c.* Theſe expreſſions indeed are clear and diſtinct, and the mind finds no difficulty in conceiving them to be continued beyond any aſſignable bounds. But if we remove the veil and look underneath, if laying aſide the expreſſions we ſet ourſelves attentively to conſider the things themſelves, which are ſuppoſed to be expreſſed or marked thereby, we ſhall diſcover much emptineſs, darkneſs, and confuſion; nay, if I miſtake not, direct impoſſibilities and contradictions. Whether this be the caſe or no, every thinking reader is intreated to examine and judge for himſelf.

IX. Having

IX. Having conſidered the object, I proceed to conſider the principles of this new analyſis by momentums, fluxions, or infiniteſimals; wherein if it ſhall appear that your capital points, upon which the reſt are ſuppoſed to depend, include error and falſe reaſoning; it will then follow that you, who are at a loſs to conduct yourſelves, cannot with any decency ſet up for guides to other men. The main point in the method of fluxions is to obtain the fluxion or momentum of the rectangle or product of two indeterminate quantities. Inaſmuch as from thence are derived rules for obtaining the fluxions of all other products and powers; be the coefficients or the indexes what they will, integers or fractions, rational or ſurd. Now this fundamental point one would think ſhould be very clearly made out, conſidering how much is built upon it, and that its influence extends throughout the whole analyſis. But let the reader judge. This is given for demonſtration. * Suppoſe the product or rectangle $A\,B$ increaſed by continual motion: and that the momentaneous increments of the ſides A and B are a and b. When the ſides A and B were deficient, or leſſer by one half of their moments, the rectangle was $\overline{A-\frac{1}{2}a} \times \overline{B-\frac{1}{2}b}$ i. e. $AB-\frac{1}{2}a\,B-\frac{1}{2}b\,A+\frac{1}{4}ab$. And as ſoon as the ſides A and B are increaſed by the other two halves of their moments, the rectangle becomes $\overline{A+\frac{1}{2}a} \times \overline{B+\frac{1}{2}b}$ or $AB+\frac{1}{2}aB+\frac{1}{2}b\,A+\frac{1}{4}ab$. From the latter rectangle ſubduct the former, and the remaining difference will be $a\,B+b\,A$. Therefore the increment of the rectangle generated by the intire increments a and b is $a\,B+b\,A$. Q. E. D. But it is plain that the direct and true method to obtain the moment or increment of the rectangle $A\,B$, is to take the ſides as increaſed by their whole increments, and ſo multiply them together, $A+a$ by $B+b$, the product whereof $AB+a\,B+b\,A+ab$ is the augmented rectangle; whence if we ſubduct $A\,B$, the remainder $a\,B+b\,A+a\,b$ will be the true increment of the rectangle, exceeding that which was obtained by the former illegitimate and indirect

* Naturalis philoſophiæ principia mathematica, l. 2. lem. 2.

method by the quantity *a b*. And this holds univerſally by the quantities *a* and *b* be what they will, big or little, finite or infiniteſimal, increments, moments, or velocities. Nor will it avail to ſay that *a b* is a quantity exceeding ſmall: ſince we are told that *in rebus mathematicis errores quam minimi non ſunt contemnendi.*

X. * Such reaſoning as this for demonſtration, nothing but the obſcurity of the ſubject could have encouraged or induced the great author of the fluxionary method to put upon his followers, and nothing but an implicit deference to authority could move them to admit. The caſe indeed is difficult. There can be nothing done till you have got rid of the quantity *a b*. In order to this the notion of fluxions is ſhifted: it is placed in various lights: points which ſhould be clear as firſt principles are puzzled; and terms which ſhould be ſteadily uſed are ambiguous. But notwithſtanding all this addreſs and ſkill the point of getting rid of *a b* cannot be obtained by legitimate reaſoning. If a man by methods, not geometrical or demonſtrative, ſhall have ſatisfied himſelf of the uſefulneſs of certain rules; which he afterwards ſhall propoſe to his diſciples for undoubted truths; which he undertakes to demonſtrate in a ſubtil manner, and by the help of nice and intricate notions; it is not hard to conceive that ſuch his diſciples may, to ſave themſelves the trouble of thinking, be inclined to confound the uſefulneſs of a rule with the certainty of a truth, and accept the one for the other; eſpecially if they are men accuſtomed rather to compute than to think; earneſt rather to go on faſt and far, than ſolicitous to ſet out warily and ſee their way diſtinctly.

XI. The points or meer limits of naſcent lines are undoubtedly equal, as having no more magnitude one than another, a limit as ſuch being no quantity. If by a momentum you mean more than the initial limit, it

* Introd. ad quadraturam curvarum.

muſt

muſt be either a finite quantity or an infiniteſimal. But all finite quantities are expreſly excluded from the notion of a momentum. Therefore the momentum muſt be an infiniteſimal. And indeed, though much artifice hath been employed to eſcape or avoid the admiſſion of quantities infinitely ſmall, yet it ſeems ineffectual. For ought I ſee, you can admit no quantity as a medium between a finite quantity and nothing, without admitting infiniteſimals. An increment generated in a finite particle of time, is itſelf a finite particle; and cannot therefore be a momentum. You muſt therefore take an infiniteſimal part of time wherein to generate your momentum. It is ſaid, the magnitude of moments is not conſidered. And yet theſe ſame moments are ſuppoſed to be divided into parts. This is not eaſy to conceive, nor more than it is why we ſhould take quantities leſs than A and B in order to obtain the increment of $A\,B$, of which proceeding it muſt be owned the final cauſe or motive is obvious; but it is not ſo obvious or eaſy to explain a juſt and legitimate reaſon for it, or ſhew it to be geometrical.

XII. From the foregoing principle ſo demonſtrated, the general rule for finding the fluxion of any power of a flowing quantity is derived *. But, as there ſeems to have been ſome inward ſcruple or conſciouſneſs of defect in the foregoing demonſtration, and as this finding the fluxion of a given power is a point of primary importance, it hath therefore been judged proper to demonſtrate the ſame in a different manner independent of the foregoing demonſtration. But whether this other method be more legitimate and concluſive than the former, I proceed now to examine; and in order thereto ſhall premiſe the following lemma. " If with a view to demonſtrate " any propoſition, a certain point is ſuppoſed, by virtue of which " certain other points are attained, and ſuch ſuppoſed point be itſelf

* Philoſophiæ naturalis principia mathematica, lib. 2. lem. 2.

" afterwards

" afterwards deſtroyed or rejected by a contrary ſuppoſition; in that " caſe, all the other points, attained thereby and conſequent there- " upon, muſt alſo be deſtroyed and rejected, ſo as from thenceforward " to be no more ſuppoſed or applied in the demonſtration." This is ſo plain as to need no proof.

XIII. Now the other method of obtaining a rule to find the fluxion of any power is as follows. Let the quantity x flow uniformly, and be it propoſed to find the fluxion of x^n. In the ſame time that x by flowing becomes $x+o$, the power x^n becomes $\overline{x+o}\,|^n$, i. e. by the method of infinite ſeries $x^n + n\,o\,x^{n-1} + \frac{nn-n}{2}\,o\,o\,x^{n-2} + \&c.$ and the increments o and $n\,o\,x^{n-1} + \frac{nn-n}{2}\,o\,o\,x^{n-2} + \&c.$ are one to another as 1 to $n\,x^{n-1} + \frac{nn-n}{2}\,o\,x^{n-2} + \&c.$ Let now the increments vaniſh, and their laſt proportion will be 1 to $n\,x^{n-1}$. But it ſhould ſeem that this reaſoning is not fair or concluſive. For when it is ſaid, let the increments vaniſh, *i. e.* let the increments be nothing, or let there be no increments, the former ſuppoſition that the increments were ſomething, or that there were increments, is deſtroyed, and yet a conſequence of that ſuppoſition, *i. e.* an expreſſion got by virtue thereof, is retained. Which, by the foregoing lemma, is a falſe way of reaſoning. Certainly when we ſuppoſe the increments to vaniſh, we muſt ſuppoſe their proportions, their expreſſions, and every thing elſe derived from the ſuppoſition of their exiſtence to vaniſh with them.

XIV. To make this point plainer, I ſhall unfold the reaſoning, and propoſe it in a fuller light to your view. It amounts therefore to this, or may in other words be thus expreſſed. I ſuppoſe that the quantity x flows, and by flowing is increaſed, and its increment I call

call o, ſo that by flowing it becomes $x+o$. And as x increaſeth, it follows that every power of x is likewiſe increaſed in a due proportion. Therefore as x becomes $x+o$, x^n will become $\overline{x+o}\,|\,^n$: that is, according to the method of infinite ſeries, $x^n+n\,o\,x^{n-1}+\frac{nn-n}{2}\,o\,o\,x^{n-2}+$ &c. And if from the two augmented quantities we ſubduct the root and the power reſpectively, we ſhall have remaining the two increments, to wit, o and $n\,o\,x^{n-1}+\frac{nn-n}{2}\,o\,o\,x^{n-2}+$ &c. which increments, being both divided by the common diviſor o, yield the quotients 1 and $n\,x^{n-1}+\frac{nn-n}{2}\,o\,x^{n-2}+$ &c. which are therefore exponents of the ratio of the increments. Hitherto I have ſuppoſed that x flows, that x hath a real increment that o is ſomething. And I have proceeded all along on that ſuppoſition, without which I ſhould not have been able to have made ſo much as one ſingle ſtep. From that ſuppoſition it is that I get at the increment of x^n, that I am able to compare it with the increment of x, and that I find the proportion between the two increments. I now beg leave to make a new ſuppoſition contrary to the firſt, *i. e.* I will ſuppoſe that there is no increment of x, or that o is nothing; which ſecond ſuppoſition deſtroys my firſt, and is inconſiſtent with it, and therefore with every thing that ſuppoſeth it. I do nevertheleſs beg leave to retain $n\,x\,n-1$, which is an expreſſion obtained in virtue of my firſt ſuppoſition, which neceſſarily pre-ſuppoſed ſuch ſuppoſition, and which could not be obtained without it. All which ſeems a moſt inconſiſtent way of arguing, and ſuch as would not be allowed of in divinity.

XV. Nothing is plainer than that no juſt concluſion can be directly drawn from two inconſiſtent ſuppoſitions. You may indeed ſuppoſe any thing

thing poſſible; but afterwards you may not ſuppoſe any thing that deſtroys what you firſt ſuppoſed. Or if you do, you muſt begin *de novo.* If therefore you ſuppoſe that the augments vaniſh, *i. e.* that there are no augments, you are to begin again, and ſee what follows from ſuch ſuppoſition. But nothing will follow to your purpoſe. You cannot by that means ever arrive at your concluſion, or ſucceed in, what is called by the celebrated author, the inveſtigation of the firſt or laſt proportions of naſcent and evaneſcent quantities, by inſtituting the analyſis in finite ones. I repeat it again: you are at liberty to make any poſſible ſuppoſition: and you may deſtroy one ſuppoſition by another: but then you may not retain the conſequences, or any part of the conſequences of your firſt ſuppoſition ſo deſtroyed. I admit that ſigns may be made to denote either any thing or nothing: and conſequently that in the original notation $x + o$, o might have ſignified either an increment or nothing. But then which of theſe ſoever you make it ſignify, you muſt argue conſiſtently with ſuch its ſignification, and not proceed upon a double meaning: which to do were a manifeſt ſophiſm. Whether you argue in ſymbols or in words, the rules of right reaſon are ſtill the ſame. Nor can it be ſuppoſed, you will plead a privilege in mathematicks to be exempt from them.

XVI. If you aſſume at firſt a quantity increaſed by nothing, and in the expreſſion $x + o$, o ſtands for nothing, upon this ſuppoſition as there is no increment of the root, ſo there will be no increment of the power; and conſequently there will be none except the firſt, of all thoſe members of the ſeries conſtituting the power of the binomial; and will therefore never come to your expreſſion of a fluxion legitimately by ſuch method. Hence you are driven into the fallacious way of proceeding to a certain point on the ſuppoſition of an increment, and then at once ſhifting your ſuppoſition to that of no increment. There may ſeem great ſkill in doing this at a certain point or period. Since if this

this ſecond ſuppoſition had been made before the common diviſion by o, all had vaniſhed at once, and you muſt have got nothing by your ſuppoſition. Whereas by this artifice of firſt dividing, and then changing your ſuppoſition, you retain 1 and $n\,x^n - 1$. But, notwithſtanding all this addreſs to cover it, the fallacy is ſtill the ſame. For whether it be done ſooner or later, when once the ſecond ſuppoſition or aſſumption is made, in the ſame inſtant the former aſſumption and all that you got by it is deſtroyed, and goes out together. And this is univerſally true, be the ſubject what it will, throughout all the branches of human knowledge; in any other of which, I believe men would hardly admit ſuch a reaſoning as this, which in mathematicks is accepted for demonſtration.

XVII. It may not be amiſs to obſerve, that the method for finding the fluxion of a rectangle of two flowing quantities, as it is ſet forth in the Treatiſe of Quadratures, differs from the abovementioned taken from the ſecond book of the Principles, and is in effect the ſame with that uſed in the *calculus differentialis* *. For the ſuppoſing a quantity infinitely diminiſhed, and therefore rejecting it, is in effect the rejecting an infiniteſimal; and indeed it requires a marvellous ſharpneſs of diſcernment, to be able to diſtinguiſh between evaneſcent increments and infiniteſimal differences. It may perhaps be ſaid that the quantity being infinitely diminiſhed becomes nothing, and ſo nothing is rejected. But according to the received principles it is evident, that no geometrical quantity can by any diviſion or ſubdiviſion whatſoever be exhauſted, or reduced to nothing. Conſidering the various arts and devices uſed by the great author of the fluxionary method, in how many lights he placeth his fluxions, and in what different ways he attempts to demonſtrate the ſame point; one would be inclined to think, he was himſelf ſuſpicious of the juſtneſs of his own demonſtrations, and that he was not enough pleaſed with any one notion ſteadily to adhere to it. Thus much at leaſt is plain, that

* Analyſe des infiniment petits, part. 1. prop. 2.

he owned himſelf ſatisfied concerning certain points, which nevertheleſs he would not undertake to demonſtrate to others *. Whether this ſatisfaction aroſe from tentative methods or inductions, which have often been admitted by mathematicians, (for inſtance by Dr. *Wallis* in his Arithmetic of Infinites) is what I ſhall not pretend to determine. But whatever the caſe might have been with reſpect to the author, it appears that his followers have ſhewn themſelves more eager in applying his method, than accurate in examining his principles.

XVIII. It is curious to obſerve, what ſubtilty and ſkill this great genius employs to ſtruggle with an inſuperable difficulty; and through what labyrinths he endeavours to eſcape the doctrine of infiniteſimals; which as it intrudes upon him whether he will or no, ſo it is admitted and embraced by others without the leaſt repugnance; *Leibnitz* and his followers in their *calculus differentialis* making no manner of ſcruple, firſt to ſuppoſe, and ſecondly to reject quantities infinitely ſmall: with what clearneſs in the apprehenſion and juſtneſs in the reaſoning, any thinking man, who is not prejudiced in favour of thoſe things, may eaſily diſcern. The notion or idea of an infiniteſimal quantity, as it is an object ſimply apprehended by the mind, hath been already conſidered †. I ſhall now only obſerve as to the method of getting rid of ſuch quantities, that it is done without the leaſt ceremony. As in fluxions the point of firſt importance, and which paves the way to the reſt, is to find the fluxion of a product of two indeterminate quantities, ſo in the *calculus differentialis* (which method is ſuppoſed to have been borrowed from the former with ſome ſmall alterations) the main point is to obtain the difference of ſuch product. Now the rule for this is got by rejecting the product or rectangle of the differences. And in general it is ſuppoſed, that no quantity is bigger or leſſer for the addition or ſubduction of its infiniteſimal: and conſequently no error can ariſe from ſuch rejection of infiniteſimals.

* See Letter to Collins, Nov. 9, 1679. † Sect. 5. and 6.

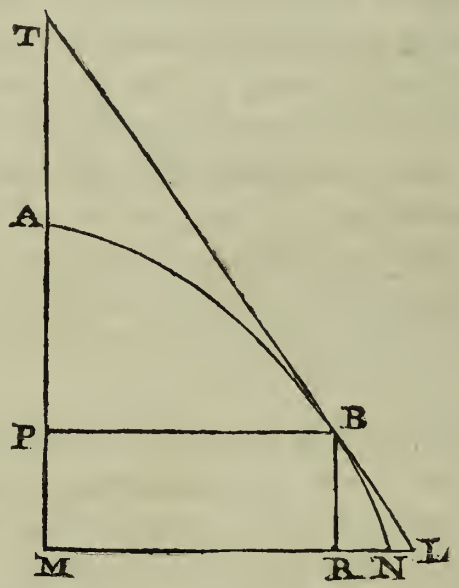
XIX.

XIX. And yet it ſhould ſeem that, whatever errors are admitted in the premiſes, proportional errors ought to be apprehended in the concluſion, be they finite or infiniteſimal: and therefore the ἀκριβεία of geometry requires nothing ſhould be neglected or rejected. In anſwer to this you will perhaps ſay, that the concluſions are accurately true, and that therefore the principles and methods from whence they are derived muſt be ſo too. But this inverted way of demonſtrating your principles by your concluſions, as it would be peculiar to you gentlemen, ſo it is contrary to the rules of logic. The truth of the concluſion will not prove either the form or the matter of a ſyllogiſm to be true; inaſmuch as the illation might have been wrong or the premiſes falſe, and the concluſion nevertheleſs true, though not in virtue of ſuch illation or of ſuch premiſes. I ſay that in every other ſcience men prove their concluſions by their principles, and not their principles by the concluſions. But if in yours you ſhould allow yourſelves this unnatural way of proceeding, the conſequence would be that you muſt take up with induction, and bid adieu to demonſtration. And if you ſubmit to this, your authority will no longer lead the way in points of reaſon and ſcience.

XX. I have no controverſy about your concluſions, but only about your logic and method: how you demonſtrate? what objects you are converſant with, and whether you conceive them clearly? what principles you proceed upon; how ſound they may be; and how you apply them? It muſt be remembered that I am not concerned about the truth of your theorems, but only about the way of coming at them; whether it be legitimate or illegitimate, clear or obſcure, ſcientific or tentative. To prevent all poſſibility of your miſtaking me, I beg leave to repeat and inſiſt, that I conſider the geometrical Analyſt as a logician, *i. e.* ſo far forth as he reaſons and argues, and his mathematical concluſions, not in themſelves, but in their premiſes; not as true or falſe, uſeful or inſignificant, but as derived from ſuch principles, and by ſuch inferences. And

foraſmuch as it may perhaps ſeem an unaccountable paradox, that mathematicians ſhould deduce true propoſitions from falſe principles, be right in the concluſion, and yet err in the premiſes; I ſhall endeavour particularly to explain why this may come to paſs, and ſhew how error may bring forth truth, though it cannot bring forth ſcience.

XXI. In order therefore to clear up this point, we will ſuppoſe for inſtance that a tangent is to be drawn to a parabola, and examine the progreſs of this affair, as it is performed by infiniteſimal differences.



Let AB be a curve, the abſciſſe $AP=x$, the ordinate $PB=y$, the difference of the abſciſſe $PM=dx$, the difference of the ordinate $RN=dy$. Now by ſuppoſing the curve to be a polygon, and conſequently BN, the increment or difference of the curve, to be a ſtraight line coincident with the tangent, and the differential triangle BRN to be ſimilar to the triangle TPB, the ſubtangent PT is found a fourth proportional to RN: $RB : PB$: that is to $dy : dx : y$. Hence the ſubtangent will be $\frac{ydx}{dy}$. But herein

herein there is an error ariſing from the forementioned falſe ſuppoſition, whence the value of PT comes out greater than the truth: for in reality it is not the triangle RNB but RLB, which is ſimilar to PBT, and therefore (inſtead of RN) RL ſhould have been the firſt term of the proportion, *i. e.* $RN+NL$, *i. e.* $dy+z$: whence the true expreſſion for the ſubtangent ſhould have been $\frac{y\,dx}{dy+z}$. There was therefore an error of defect in making dy the diviſor: which error was equal to z, *i. e.* NL the line comprehended between the curve and the tangent. Now by the nature of the curve $yy=px$, ſuppoſing p to be the parameter, whence by the rule of differences $2y\,dy=p\,dx$ and $dy=\frac{p\,dx}{2y}$. But if you multiply $y+dy$ by itſelf, and retain the whole product without rejecting the ſquare of the difference, it will then come out, by ſubſtituting the augmented quantities in the equation of the curve, that $dy=\frac{p\,dx}{2y}-\frac{dy\,dy}{2y}$ truly. There was therefore an error of exceſs in making $dy=\frac{p\,dx}{2y}$, which followed from the erroneous rule of differences. And the meaſure of this ſecond error is $\frac{dy\,dy}{2y}=z$. Therefore the two errors being equal and contrary deſtroy each other; the firſt error of defect being corrected by a ſecond error of exceſs.

XXII. If you had committed only one error, you would not have come at a true ſolution of the problem. But by virtue of a twofold miſtake you arrive, though not at ſcience, yet at truth. For ſcience it cannot be called, when you proceed blindfold, and arrive at the truth not knowing how or by what means. To demonſtrate that z is equal to $\frac{dy\,dy}{2y}$, let BR

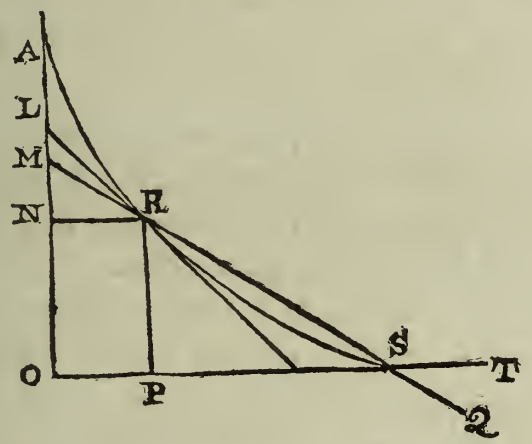
or

or dx be m, and RN or dy be n. By the thirty third propoſition of the firſt book of the Conics of *Apollonius*, and from ſimilar triangles, as $2x$ to y ſo is m to $n+z=\frac{my}{2x}$. Likewiſe from the nature of the parabola $yy+2yn+nn=xp+mp$, and $2yn+nn=mp$: wherefore $\frac{2yn+nn}{p}=m$: and becauſe $yy=px$, $\frac{yy}{p}$ will be equal to x. Therefore ſubſtituting theſe values inſtead of m and x we ſhall have $n+z=\frac{my}{2x}=\frac{2yynp+ynnp}{2yyp}$: i. e. $n+z=\frac{2yn+nn}{2y}$: which being reduced gives $z=\frac{nn}{2y}=\frac{dydy}{2y}$ *Q. E. D.*

XXIII. Now I obſerve in the firſt place, that the concluſion comes out right, not becauſe the rejected ſquare of dy was infinitely ſmall; but becauſe this error was compenſated by another contrary and equal error. I obſerve in the ſecond place, that whatever is rejected, be it ever ſo ſmall, if it be real and conſequently makes a real error in the premiſes, it will produce a proportional real error in the concluſion. Your theorems therefore cannot be accurately true, nor your problems accurately ſolved, in virtue of premiſes which themſelves are not accurate; it being a rule in logic that *concluſio ſequitur partem debiliorem.* Therefore I obſerve in the third place, that when the concluſion is evident and the premiſes obſcure, or the concluſion accurate and the premiſes inaccurate, we may ſafely pronounce that ſuch concluſion is neither evident nor accurate, in virtue of thoſe obſcure inaccurate premiſes or principles; but in virtue of ſome other principles which perhaps the demonſtrator himſelf never knew or thought of. I obſerve in the laſt place, that in caſe the differences are ſuppoſed finite quantities ever ſo great, the concluſion will nevertheleſs come out the ſame; inaſmuch as the rejected quantities

quantities are legitimately thrown out, not for their ſmallneſs, but for another reaſon, to wit, becauſe of contrary errors, which deſtroying each other do upon the whole cauſe that nothing is really, though ſomething is apparently thrown out. And this reaſon holds equally, with reſpect to quantities finite as well as infiniteſimal, great as well as ſmall, a foot or a yard long as well as the minuteſt increment.

XXIV. For the fuller illuſtration of this point, I ſhall conſider it in another light, and proceeding in finite quantities to the concluſion, I ſhall



only then make uſe of one infiniteſimal. Suppoſe the ſtraight line MQ cuts the curve AT in the points R and S. Suppoſe LR a tangent at the point R, AN the abſciſſe, NR and OS ordinates. Let AN be produced to O, and RP be drawn parallel to NO. Suppoſe $AN = x$, $NR = y$, $NO = v$, $PS = z$, the ſubſecant $MN = S$. Let the equation $y = xx$ expreſs the nature of the curve: and ſuppoſing y and x increaſed by their finite increments, we get $y + z = xx + 2xv + vv$: whence the former equation being ſubducted, there remains $z = 2xv + vv$. And by reaſon of ſimilar triangles $PS : PR :: NR : NM$, i. e. $z : v :: y : s = \frac{vy}{z}$, wherein if for y and z we ſubſtitute their values, we get

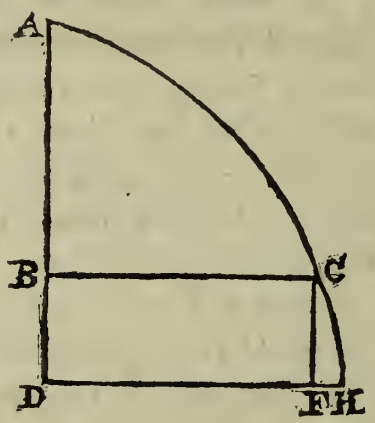
$\frac{vxx}{2xv+vv} = s = \frac{xx}{2x+v}$. And ſuppoſing NO to be infinitely diminiſhed, the ſubſecant NM will in that caſe coincide with the ſubtangent NL, and v as an infiniteſimal may be rejected: whence it follows that $S = NL = \frac{xx}{2x} = \frac{x}{2}$; which is the true value of the ſubtangent. And ſince this was obtained by one only error, *i. e.* by once rejecting one only infiniteſimal, it ſhould ſeem, contrary to what hath been ſaid, that an infiniteſimal quantity or difference may be neglected or thrown away, and the concluſion nevertheleſs be accurately true, although there was no double miſtake or rectifying of one error by another, as in the firſt caſe. But if this point be throughly conſidered, we ſhall find there is even here a double miſtake, and that one compenſates or rectifies the other. For in the firſt place, it was ſuppoſed, that when NO is infinitely diminiſhed or becomes an infiniteſimal, then the ſubſequent NM becomes equal to the ſubtangent NL. But this is a plain miſtake; for it is evident, that as a ſecant cannot be a tangent, ſo a ſubſecant cannot be a ſubtangent. Be the difference ever ſo ſmall, yet ſtill there is a difference. And if NO be infinitely ſmall, there will even then be an infinitely ſmall difference between NM and NL. Therefore NM or S was too little for your ſuppoſition, (when you ſuppoſed it equal to NL) and this error was compenſated by a ſecond error in throwing out v, which laſt error made s bigger than its true value, and in lieu thereof gave the value of the ſubtangent. This is the true ſtate of the caſe, however it may be diſguiſed. And to this in reality it amounts, and is at bottom the ſame thing, if we ſhould pretend to find the ſubtangent by having firſt found, from the equation of the curve and ſimilar triangles, a general expreſſion for all ſubſecants, and then reducing the ſubtangent under this general rule, by conſidering it as the ſubſecant when v vaniſhes or becomes nothing.

XXV.

XXV. Upon the whole I obſerve, Firſt, that v can never be nothing, ſo long as there is a ſecant. Secondly, that the ſame line cannot be both tangent and ſecant. Thirdly, that when v or NO * vaniſheth, PS and SR do alſo vaniſh, and with them the proportionality of the ſimilar triangles. Conſequently the whole expreſſion, which was obtained by means thereof and grounded thereupon, vaniſheth when v vaniſheth. Fourthly, that the method for finding ſecants or the expreſſion of ſecants, be it ever ſo general, cannot in common ſenſe extend any further than to all ſecants whatſoever: and, as it neceſſarily ſuppoſed ſimilar triangles, it cannot be ſuppoſed to take place where there are not ſimilar triangles. Fifthly, that the ſubſecant will always be leſs than the ſubtangent, and can never coincide with it; which coincidence to ſuppoſe would be abſurd; for it would be ſuppoſing the ſame line at the ſame time to cut and not to cut another given line, which is a manifeſt contradiction, ſuch as ſubverts the hypotheſis and gives a demonſtration of its falſhood. Sixthly, if this be not admitted, I demand a reaſon why any other apagogical demonſtration, or demonſtration *ad abſurdum* ſhould be admitted in geometry rather than this; or that ſome real difference be aſſigned between this and others as ſuch. Seventhly, I obſerve that it is ſophiſtical to ſuppoſe NO or RP, PS, and SR to be finite real lines in order to form the triangle RPS, in order to obtain proportions by ſimilar triangles; and afterwards to ſuppoſe there are no ſuch lines, nor conſequently ſimilar triangles, and nevertheleſs to retain the conſequence of the firſt ſuppoſition, after ſuch ſuppoſition hath been deſtroyed by a contrary one. Eighthly, That although, in the preſent caſe, by inconſiſtent ſuppoſitions truth may be obtained, yet ſuch truth is not demonſtrated; that ſuch method is not conformable to the rules of logic and right reaſon; that, however uſeful it may be, it muſt be conſidered only as a preſumption, as a knack, an art rather an artifice, but not a ſcientific demonſtration.

* See the foregoing Figure.

XXVI. The doctrine premiſed may be farther illuſtrated by the following ſimple and eaſy caſe, wherein I ſhall proceed by evaneſcent increments. Suppoſe $AB = x$, $BC = y$, $BD = o$, and that xx is equal to



the area ABC: it is propoſed to find the ordinate y or BC. When x by flowing becomes $x + o$, then xx becomes $xx + 2xo + oo$: and the area ABC becomes ADH, and the increment of xx will be equal to $BDHC$ the increment of the area, *i. e.* to $BCFD + CFH$. And if we ſuppoſe the curvilinear ſpace CFH to be qoo, then $2xo + oo = yo + qoo$ which divided by o gives $2x + o = y + qo$. And, ſuppoſing o to vaniſh, $2x = y$, in which caſe ACH will be a ſtraight line, and the areas ABC, CFH, triangles. Now with regard to this reaſoning, it hath been already remarked *, that it is not legitimate or logical to ſuppoſe o to vaniſh, *i. e.* to be nothing, *i. e.* that there is no increment, unleſs we reject at the ſame time with the increment itſelf every conſequence of ſuch increment, *i. e.* whatſoever could not be obtained but by ſuppoſing ſuch increment. It muſt nevertheleſs be acknowledged, that the problem is rightly ſolved, and the concluſion true, to which we are led by this method. It will therefore be aſked, how comes it to paſs that the throwing out o is attended with no error in the concluſion? I anſwer, the

* Sect. 12. and 13. ſupra.

true

true reaſon hereof is plainly this: becauſe q being unit, $q\,o$ is equal to o: and therefore $2\,x + o - q\,o = y = 2\,x$, the equal quantities $q\,o$ and o being deſtroyed by contrary ſigns.

XXVII. As on the one hand it were abſurd to get rid of o by ſaying, let me contradict myſelf; let me ſubvert my own hypotheſis; let me take it for granted that there is no increment, at the ſame time that I retain a quantity, which I could never have got at but by aſſuming an increment: ſo on the other hand it would be equally wrong to imagine, that in a geometrical demonſtration we may be allowed to admit any error, though ever ſo ſmall, or that it is poſſible, in the nature of things, an accurate concluſion ſhould be derived from inaccurate principles. Therefore o cannot be thrown out as an infiniteſimal, or upon the principle that infiniteſimals may be ſafely neglected; but only becauſe it is deſtroyed by an equal quantity with a negative ſign, whence $o - p\,o$ is equal to nothing. And as it is illegitimate to reduce an equation, by ſubducting from one ſide a quantity when it is not to be deſtroyed, or when an equal quantity is not ſubducted from the other ſide of the equation: ſo it muſt be allowed a very logical and juſt method of arguing, to conclude that if from equals either nothing or equal quantities are ſubducted, they ſhall ſtill remain equal. And this is a true reaſon why no error is at laſt produced by the rejecting of o. Which therefore muſt not be aſcribed to the doctrine of differences, or infiniteſimals, or evaneſcent quantities, or momentums, or fluxions.

XXVIII. Suppoſe the caſe to be general, and that x^n is equal to the area $A\,B\,C$, whence by the method of fluxions the ordinate is found $n\,x^{n-1}$, which we admit for true, and ſhall inquire how it is arrived at. Now if we are content to come at the concluſion in a ſummary way, by ſuppoſing that the ratio of the fluxions of x and x^n is found * to be 1

* Sect. 13.

and $n x^{n-1}$, and that the ordinate of the area is conſidered as its fluxion; we ſhall not ſo clearly ſee our way, or perceive how the truth comes out, that method as we have ſhewed before being obſcure and illogical. But if we fairly delineate the area and its increment, and divide the latter into two parts $BCFD$ and CFH*, and proceed regularly by equations between the algebraical and geometrical quantities, the reaſon of the thing will plainly appear. For as x^n is equal to the area ABC, ſo is the increment of x^n equal to the increment of the area, *i. e.* to $BDHC$; that is to ſay, $n o x^{n-1} + \frac{nn-n}{2} oo x^{n-2} + \&c. = BDFC + CFH.$ And only the firſt members on each ſide of the equation being retained, $n o x^{n-1} = BDFC$: and dividing both ſides by o or BD, we ſhall get $n x^{n-1} = BC$. Admitting therefore, that the curvilinear ſpace CFH is equal to the rejectaneous quantity $\frac{nn-n}{2} oo x^{n-2} + \&c.$ and that when this is rejected on one ſide, that is rejected on the other, the reaſoning becomes juſt and the concluſion true. And it is all one whatever magnitude you allow to BD, whether that of an infiniteſimal difference or a finite increment ever ſo great. It is therefore plain, that the ſuppoſing the rejectaneous algebraical quantity to be an infinitely ſmall or evaneſcent quantity, and therefore to be neglected, muſt have produced an error, had it not been for the curvilinear ſpaces being equal thereto, and at the ſame time ſubducted from the other part or ſide of the equation, agreeably to the axiom; *If from equals you ſubduct equals, the remainders will be equal.* For thoſe quantities which by the analyſts are ſaid to be neglected, or made to vaniſh, are in reality ſubducted. If therefore the concluſion be true, it is abſolutely neceſſary that the finite ſpace CFH be equal to the remainder of the increment expreſſed by $\frac{nn-n}{2} oo x^{n-2} \&c.$ equal I ſay to the finite remainder of a finite increment.

* See the Figure in Sect. 26.

XXIX.

XXIX. Therefore, be the power what you pleaſe, there will ariſe on one ſide an algebraical expreſſion, on the other a geometrical quantity, each of which naturally divides itſelf into three members: the algebraical or fluxionary expreſſion into one, which includes neither the expreſſion of the increment of the abſciſs nor of any power thereof, another which includes the expreſſion of the increment itſelf, and a third including the expreſſion of the powers of the increment. The geometrical quantity alſo or whole increaſed area conſiſts of three parts or members, the firſt of which is the given areas the ſecond a rectangle under the ordinate and the increment of the abſciſs, and the third a curvilinear ſpace. And, comparing the homologous or correſpondent members on both ſides, we find that as the firſt member of the expreſſion is the expreſſion of the given area, ſo the ſecond member of the expreſſion will expreſs the rectangle or ſecond member of the geometrical quantity; and the third, containing the powers of the increment, will expreſs the curvilinear ſpace, or third member of the geometrical quantity. This hint may perhaps be further extended, and applied to good purpoſe, by thoſe who have leiſure and curioſity for ſuch matters. The uſe I make of it is to ſhew, that the analyſis cannot obtain in augments or differences, but it muſt alſo obtain in finite quantities, be they ever ſo great, as was before obſerved.

XXX. It ſeems therefore upon the whole, that we may ſafely pronounce the concluſion cannot be right, if in order thereto any quantity be made to vaniſh, or be neglected, except that either one error is redreſſed by another; or that ſecondly, on the ſame ſide of an equation equal quantities are deſtroyed by contrary ſigns, ſo that the quantity we mean to reject is firſt annihilated; or laſtly, that from the oppoſite ſides equal quantities are ſubducted. And therefore to get rid of quantities by the received principles of fluxions or of differences is neither good geometry nor good logic. When the augments vaniſh, the velocities alſo vaniſh.

vaniſh. The velocities or fluxions are ſaid to be *primò* and *ultimò*, as the augments naſcent and evaneſcent. Take therefore the *ratio* of the evaneſcent quantities, it is the ſame with that of the fluxions: it will therefore anſwer all intents as well. Why then are fluxions introduced? Is it not to ſhun or rather to palliate the uſe of quantities infinitely ſmall? But we have no notion whereby to conceive and meaſure various degrees of velocity, beſides ſpace and time, or when the times are given, beſides ſpace alone. We have even no notion of velocity preſcinded from time and ſpace. When therefore a point is ſuppoſed to move in given times, we have no notion of greater or leſſer velocities or of proportions between velocities, but only of longer or ſhorter lines, and of proportions between ſuch lines generated in equal parts of time.

XXXI. A point may be the limit of a line: a line may be the limit of a ſurface: a moment may terminate time. But how can we conceive a velocity by the help of ſuch limits? It neceſſarily implies both time and ſpace, and cannot be conceived without them. And if the velocities of naſcent and evaneſcent quantities, *i. e.* abſtracted from time and ſpace, may not be comprehended, how can we comprehend and demonſtrate their proportions; or conſider their *rationes primæ* and *ultimæ?* For to conſider the proportion or *ratio* of things implies that ſuch things have magnitude; that ſuch their magnitudes may be meaſured, and their relations to each other known. But, as there is no meaſure of velocity except time and ſpace, the proportion of velocities being only compounded of the direct proportion of the ſpaces and the reciprocal proportion of the times; doth it not follow that to talk of inveſtigating, obtaining, and conſidering the proportions of velocities, excluſively of time and ſpace, is to talk unintelligibly?

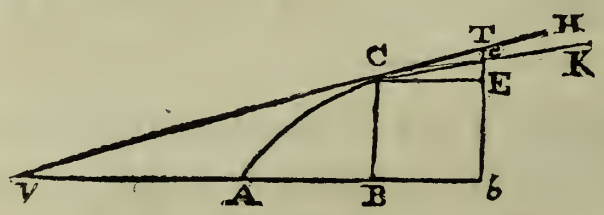
XXXII. But you will ſay that, in the uſe and application of fluxions, men do not overſtrain their faculties to a preciſe conception of the above-mentioned

mentioned velocities, increments, infiniteſimals, or any other ſuch like ideas of a nature ſo nice, ſubtil, and evaneſcent. And therefore you will perhaps maintain, that problems may be ſolved without thoſe inconceivable ſuppoſitions; and that, conſequently, the doctrine of fluxions, as to the practical part, ſtands clear of all ſuch difficulties. I anſwer, that if in the uſe or application of this method thoſe difficult and obſcure points are not attended to, they are nevertheleſs ſuppoſed. They are the foundations on which the moderns build the principles on which they proceed, in ſolving problems and diſcovering theorems. It is with the method of fluxions as with all other methods, which preſuppoſe their reſpective principles and are grounded thereon; although the rules may be practiſed by men who neither attend to, nor perhaps know the principles. In like manner, therefore, as a ſailor may practically apply certain rules derived from aſtronomy and geometry, the principles whereof he doth not underſtand; and as any ordinary man may ſolve divers numerical queſtions, by the vulgar rules and operations of arithmetic, which he performs and applies without knowing the reaſons of them: even ſo it cannot be denied that you may apply the rules of the fluxionary method: you may compare and reduce particular caſes to general forms; you may operate and compute and ſolve problems thereby, not only without an actual attention to, or an actual knowledge of, the grounds of that method, and the principles whereon it depends, and whence it is deduced, but even without having ever conſidered or comprehended them.

XXXIII. But then it muſt be remembered, that in ſuch caſe although you may paſs for an artiſt, computiſt, or analyſt, yet you may not be juſtly eſteemed a man of ſcience and demonſtration. Nor ſhould any man, in virtue of being converſant in ſuch obſcure analytics, imagine his rational faculties to be more improved than thoſe of other men, which have been exerciſed in a different manner, and on different ſubjects;

jects; much leſs erect himſelf into a judge and an oracle, concerning matters that have no ſort of connexion with, or dependence on thoſe ſpecies, ſymbols or ſigns, in the management whereof he is ſo converſant and expert. As you, who are a ſkilful computiſt or analyſt, may not therefore be deemed ſkilful in anatomy; or *vice verſa*, as a man who can diſſect with art, may, nevertheleſs, be ignorant in your art of computing: even ſo you may both, notwithſtanding your peculiar ſkill in your reſpective arts, be alike unqualified to decide upon logic, or metaphyſics, or ethics, or religion. And this would be true, even admitting that you underſtood your own principles and could demonſtrate them.

XXXIV. If it is ſaid, that fluxions may be expounded or expreſſed by finite lines proportional to them; which finite lines, as they may be diſtinctly conceived and known and reaſoned upon, ſo they may be ſubſtituted for the fluxions, and their mutual relations or proportions be conſidered as the proportions of fluxions; by which means the doctrine becomes clear and uſeful: I anſwer that if, in order to arrive at theſe finite lines proportional to the fluxions, there be certain ſteps made uſe of which are obſcure and inconceivable, be thoſe finite lines themſelves ever ſo clearly conceived, it muſt nevertheleſs be acknowledged, that your proceeding is not clear nor your method ſcientific. For inſtance, it is



ſuppoſed that AB being the abſciſs, BC the ordinate, and VCH a tangent of the curve AC, Bb or CE the increment of the abſciſs, Ec the increment of the ordinate, which produced meets VH in the point T, and

and $C\,c$ the increment of the curve. The right line $C\,c$ being produced to K, there are formed three ſmall triangles, the rectilinear $C\,E\,c$ the mixtilinear $C\,E\,c$, and the rectilinear triangle $C\,E\,T$. It is evident theſe three triangles are different from each other, the rectilinear $C\,E\,c$ being leſs than the mixtilinear $C\,E\,c$, whoſe ſides are the three increments above-mentioned, and this ſtill leſs than the triangle $C\,E\,T$. It is ſuppoſed that the ordinate $b\,c$ moves into the place $B\,C$, ſo that the point c is coincident with the point C; and the right line $C\,K$, and conſequently the curve $C\,c$, is coincident with the tangent $C\,H$. In which caſe the mixtilinear evaneſcent triangle $C\,E\,c$ will, in its laſt form, be ſimilar to the triangle $C\,E\,T$: and its evaneſcent ſides $C\,E$, $E\,c$, and $C\,c$ will be proportional to $C\,E$, $E\,T$, and $C\,T$ the ſides of the triangle $C\,E\,T$. And therefore it is concluded, that the fluxions of the lines $A\,B$, $B\,C$, and $A\,C$, being in the laſt ratio of their evaneſcent increments, are proportional to the ſides of the triangle $C\,E\,T$, or, which is all one, of the triangle $V\,B\,C$ ſimilar thereunto. * It is particularly remarked and inſiſted on by the great author, that the points C and c muſt not be diſtant one from another, by any the leaſt interval whatſoever: but that, in order to find the ultimate proportions of the lines $C\,E$, $E\,c$, and $C\,c$ (*i. e.* the proportions of the fluxions or velocities) expreſſed by the finite ſides of the triangle $V\,B\,C$, the points C and c muſt be accurately coincident, *i. e.* one and the ſame. A point therefore is conſidered as a triangle, or a triangle is ſuppoſed to be formed in a point. Which to conceive ſeems quite impoſſible. Yet ſome there are, who, though they ſhrink at all other myſteries, make no difficulty of their own, who ſtrain at a gnat and ſwallow a camel.

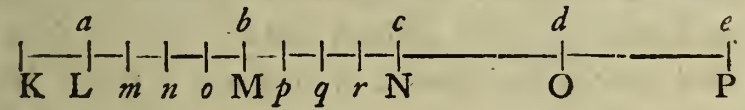
XXXV. I know not whether it be worth while to obſerve, that poſſibly ſome men may hope to operate by ſymbols and ſuppoſitions, in ſuch ſort as to avoid the uſe of fluxions, momentums, and infiniteſimals after the following manner. Suppoſe x to be one abſciſs of a curve, and z another

* Introd. ad quadraturam curvarum.

abſciſs of the ſame curve. Suppoſe alſo that the reſpective areas are xxx and zzz: and that $z-x$ is the increment of the abſciſs, and $zzz-xxx$ the increment of the area, without conſidering how great, or how ſmall thoſe increments may be. Divide now $zzz-xxx$ by $z-x$ and the quotient will be $zz+zx+xx$: and, ſuppoſing that z and x are equal, this ſame quotient will be $3xx$ which in that caſe is the ordinate, which therefore may be thus obtained independently of fluxions and infiniteſimals. But herein is a direct fallacy: for in the firſt place, it is ſuppoſed that the abſciſſes z and x are unequal, without which ſuppoſition no one ſtep could have been made; and in the ſecond place, it is ſuppoſed they are equal; which is a manifeſt inconſiſtency, and amounts to the ſame thing that hath been before conſidered *. And there is indeed reaſon to apprehend, that all attempts for ſetting the abſtruſe and fine geometry on a right foundation, and avoiding the doctrine of velocities, momentums, *&c.* will be found impracticable, till ſuch time as the object and end of geometry are better underſtood, than hitherto they ſeem to have been. The great author of the method of fluxions felt this difficulty, and therefore he gave into thoſe nice abſtractions and geometrical metaphyſics, without which he ſaw nothing could be done on the received principles; and what in the way of demonſtration he hath done with them the reader will judge. It muſt, indeed, be acknowledged, that he uſed fluxions, like the ſcaffold of a building, as things to be laid aſide or got rid of, as ſoon as finite lines were found proportional to them. But then theſe finite exponents are found by the help of fluxions. Whatever therefore is got by ſuch exponents and proportions is to be aſcribed to fluxions: which muſt therefore be previouſly underſtood. And what are theſe fluxions? The velocities of evaneſcent increments? And what are theſe ſame evaneſcent increments? They are neither finite quantities, nor quantities infinitely ſmall, nor yet nothing. May we not call them the ghoſts of departed quantities?

* Sect. 15.

XXXVI. Men too often impoſe on themſelves and others, as if they conceived and underſtood things expreſſed by ſigns, when in truth they have no idea, ſave only of the very ſigns themſelves. And there are ſome grounds to apprehend that this may be the preſent caſe. The velocities of evaneſcent or naſcent quantities are ſuppoſed to be expreſſed, both by finite lines of a determinate magnitude, and by algebraical notes or ſigns: but I ſuſpect that many who, perhaps never having examined the matter, take it for granted, would upon a narrow ſcrutiny find it impoſſible, to frame any idea or notion whatſoever of thoſe velocities, excluſive of ſuch finite quantities and ſigns.



Suppoſe the line KP deſcribed by the motion of a point continually accelerated, and that in equal particles of time the unequal parts KL, LM, MN, NO, &c. are generated. Suppoſe alſo that a, b, c, d, e, &c. denote the velocities of the generating point, at the ſeveral periods of the parts or increments ſo generated. It is eaſy to obſerve that theſe increments are each proportional to the ſum of the velocities with which it is deſcribed: that, conſequently, the ſeveral ſums of the velocities, generated in equal parts of time, may be ſet forth by the reſpective lines KL, LM, MN, &c. generated in the ſame times: it is likewiſe an eaſy matter to ſay, that the laſt velocity generated in the firſt particle of time, may be expreſſed by the ſymbol a, the laſt in the ſecond by b, the laſt generated in the third by c, and ſo on: that a is the velocity of LM in *ſtatu naſcenti*, and b, c, d, e, &c. are the velocities of the increments MN, NO, OP, &c. in their reſpective naſcent eſtates. You may proceed, and conſider theſe velocities themſelves as flowing or increaſing quantities, taking the velocities of the velocities, and the velocities of the velocities of the velocities, *i. e.* the firſt, ſecond, third, &c. velocities *ad infinitum*: which ſucceeding ſeries of velocities may be thus expreſſed, $a. b - a. c - 2b + a. d - 3$

$d - 3\ c + 3\ b - a$ &c. which you may call by the names of firſt, ſecond, third, fourth fluxions. And for an apter expreſſion you may denote the variable flowing line KL, KM, KN, &c. by the letter x; and the firſt fluxions by $\dot{x}$, the ſecond by $\ddot{x}$, the third by $\dddot{x}$, and ſo on *ad infinitum.*

XXXVII. Nothing is eaſier than to aſſign names, ſigns, or expreſſions to theſe fluxions, and it is not difficult to compute and operate by means of ſuch ſigns. But it will be found much more difficult, to omit the ſigns, and yet retain in our minds the things, which we ſuppoſe to be ſignified by them. To conſider the exponents, whether geometrical, or algebraical, or fluxionary, is no difficult matter. But to form a preciſe idea of a third velocity for inſtance, in itſelf and by itſelf, *Hoc opus, hic labor.* Nor indeed is it an eaſy point, to form a clear and diſtinct idea of any velocity at all, excluſive of and preſcinding from all length of time and ſpace; as alſo from all notes, ſigns or ſymbols whatſoever. This, if I may be allowed to judge of others by myſelf, is impoſſible. To me it ſeems evident, that meaſures and ſigns are abſolutely neceſſary, in order to conceive or reaſon about velocities; and that, conſequently when we think to conceive the velocities, ſimply and in themſelves, we are deluded by vain abſtractions.

XXXVIII. It may perhaps be thought by ſome an eaſier method of conceiving fluxions, to ſuppoſe them the velocities wherewith the infiniteſimal differences are generated. So that the firſt fluxions ſhall be the velocities of the firſt differences, the ſecond the velocities of the ſecond differences, the third fluxions the velocities of the third differences, and ſo on *ad infinitum.* But not to mention the inſurmountable difficulty of admitting or conceiving infiniteſimals, and infiniteſimals of infiniteſimals, &c. it is evident that this notion of fluxions would not conſiſt with the great author's view; who held that the minuteſt quantity ought not to be neglected, that therefore the doctrine of infiniteſimal differences was not to

to be admitted in geometry, and who plainly appears to have introduced the uſe of velocities or fluxions, on purpoſe to exclude or do without them.

XXXIX. To others it may poſſibly ſeem, that we ſhould form a juſter idea of fluxions, by aſſuming the finite unequal iſochronal increments *KL*, *LM*, *MN*, *&c.* and conſidering them in *ſtatu naſcenti*, alſo their increments in *ſtatu naſcenti*, and the naſcent increments of thoſe increments, and ſo on, ſuppoſing the firſt naſcent increments to be proportional to the firſt fluxions or velocities, the naſcent increments of thoſe increments to be proportional to the ſecond fluxions, the third naſcent increments to be proportional to the third fluxions, and ſo onwards. And, as the firſt fluxions are the velocities of the firſt naſcent increments, ſo the ſecond fluxions may be conceived to be the velocities of the ſecond naſcent increments, rather than the velocities of velocities. By which means the analogy of fluxions may ſeem better preſerved, and the notion rendered more intelligible.

XL. And indeed it ſhould ſeem, that in the way of obtaining the ſecond or third fluxion of an equation, the given fluxions were conſidered rather as increments than velocities. But the conſidering them ſometimes in one ſenſe, ſometimes in another, one while in themſelves, another in their exponents, ſeems to have occaſioned no ſmall ſhare of that confuſion and obſcurity, which is found in the doctrine of fluxions. It may ſeem therefore, that the notion might be ſtill mended, and that inſtead of fluxions of fluxions, or fluxions of fluxions of fluxions, and inſtead of ſecond, third, or fourth, *&c.* fluxions of a given quantity, it might be more conſiſtent and leſs liable to exception to ſay, the fluxion of the firſt naſcent increment, *i. e.* the ſecond fluxion; the fluxion of the ſecond naſcent increment, *i. e.* the third fluxion; the fluxion of the third naſcent increment, *i. e.* the fourth fluxion, which fluxions are conceived

reſpectively

reſpectively proportional, each to the naſcent principle of the increment ſucceeding that whereof it is the fluxion.

XLI. For the more diſtinct conception of all which it may be conſidered, that if the finite increment $L\,M$ * be divided into the iſochronal parts $L\,m$, $m\,n$, $n\,o$, $o\,M$; and the increment $M\,N$ into the parts $M\,p$, $p\,q$, $q\,r$, $r\,N$ iſochronal to the former; as the whole increments $L\,M$, $M\,N$ are proportional to the ſums of their deſcribing velocities, even ſo the homologous particles $L\,m$, $M\,p$ are alſo proportional to the reſpective accelerated velocities with which they are deſcribed. And as the velocity with which $M\,p$ is generated, exceeds that with which $L\,m$ was generated, even ſo the particle $M\,p$ exceeds the particle $L\,m$. And in general, as the iſochronal velocities deſcribing the particles of $M\,N$ exceed the iſochronal velocities deſcribing the particles of $L\,M$, even ſo the particles of the former exceed the correſpondent particles of the latter. And this will hold, be the ſaid particles ever ſo ſmall. $M\,N$ therefore will exceed $L\,M$ if they are both taken in their naſcent ſtates: and that exceſs will be proportional to the exceſs of the velocity b above the velocity a. Hence we may ſee that this laſt account of fluxions comes, in the upſhot, to the ſame thing with the firſt †.

XLII. But notwithſtanding what hath been ſaid it muſt ſtill be acknowledged, that the finite particles $L\,m$ or $M\,p$, though taken ever ſo ſmall are not proportional to the velocities a and b; but each to a ſeries of velocities changing every moment, or which is the ſame thing, to an accelerated velocity, by which it is generated, during a certain minute particle of time: that the naſcent beginnings or evaneſcent endings of finite quantities, which are produced in moments or infinitely ſmall parts of time, are alone proportional to given velocities: that therefore, in order to conceive the firſt fluxions, we muſt conceive time di-

* See the foregoing ſcheme in Sect. 36. † Sect. 36.

vided

vied into moments, increments generated in thoſe moments, and velocities proportional to thoſe increments: that in order to conceive ſecond and third fluxions, we muſt ſuppoſe that the naſcent principles or momentaneous increments have themſelves alſo other momentaneous increments, which are proportional to their reſpective generating velocities: that the velocities of theſe ſecond momentaneous increments are ſecond fluxions: thoſe of their naſcent momentaneous increments third fluxions. And ſo on *ad infinitum.*

XLIII. By ſubducting the increment generated in the firſt moment from that generated in the ſecond, we get the increment of an increment. And by ſubducting the velocity generating in the firſt moment from that generating in the ſecond, we get the fluxion of a fluxion. In like manner, by ſubducting the difference of the velocities generating in the two firſt moments, from the exceſs of the velocity in the third above that in the ſecond moment, we obtain the third fluxion. And after the ſame analogy we may proceed to fourth, fifth, ſixth fluxions, *&c.* And if we call the velocities of the firſt, ſecond, third, fourth moments a, b, c, d, the ſeries of fluxions will be as above, $a.\ b - a.\ c - 2\ b + a.\ d - 3\ c + 3$

$\therefore\ \therefore\ \therefore\ ::$

$b - a.$ *ad infinitum*, *i. e.* $x.\ x.\ x.\ x.$ *ad infinitum.*

XLIV. Thus fluxions may be conſidered in ſundry lights and ſhapes, which ſeem all equally difficult to conceive. And indeed, as it is impoſſible to conceive velocity without time or ſpace, without either finite length or finite duration *, it muſt ſeem above the powers of men to comprehend even the firſt fluxions. And if the firſt are incomprehenſible, what ſhall we ſay of the ſecond and third fluxions, *&c.*? He who can conceive the beginning of a beginning, or the end of an end, ſomewhat before the firſt or after the laſt, may be perhaps ſharpſighted enough to conceive theſe things. But moſt men will, I believe find it impoſſible to underſtand them in any ſenſe whatever.

XLV.

* Sect. 31.

XLV. One would think that men could not ſpeak too exactly on ſo nice a ſubject. And yet, as was before hinted, we may often obſerve that the exponents of fluxions or notes repreſenting fluxions are confounded with the fluxions themſelves. Is not this the caſe, when juſt after the fluxions of flowing quantities were ſaid to be the celerities of their increaſing, and the ſecond fluxions to be the mutations of the firſt fluxions or celerities, we are told that $z.\ z.\ z.\ z.\ z.\ z.$ * repreſents a ſeries of quantities, whereof each ſubſequent quantity is the fluxion of the preceding; and each foregoing is a fluent quantity having the following one for its fluxion?

XLVI. Divers ſeries of quantities and expreſſions, geometrical and algebraical, may be eaſily conceived, in lines, in ſurfaces, in ſpecies, to be continued without end or limit. But it will not be found ſo eaſy to conceive a ſeries, either of mere velocities or of mere naſcent increments, diſtinct therefrom and correſponding thereunto. Some perhaps may be led to think the author intended a ſeries of ordinates, wherein each ordinate was the fluxion of the preceding and fluent of the following, *i. e.* that the fluxion of one ordinate was itſelf the ordinate of another curve; and the fluxion of this laſt ordinate was the ordinate of yet another curve; and ſo on *ad infinitum*. But who can conceive how the fluxion (whether velocity or naſcent increment) of an ordinate? Or more than that each preceding quantity or fluent is related to its ſubſequent or fluxion, as the area of curvilinear figure to its ordinate; agreeably to what the author remarks, that each preceding quantity in ſuch ſeries is as the area of a curvilinear figure, whereof the abſciſs is z, and the ordinate is the following quantity.

XLVII. Upon the whole it appears that the celerities are diſmiſſed, and inſtead thereof areas and ordinates are introduced. But however

* De quadratura curvarum.

expedient

expedient ſuch analogies or ſuch expreſſions may be found for facilitating the modern quadratures, yet we ſhall not find any light given us thereby into the original real nature of fluxions; or that we are enabled to frame from thence juſt ideas of fluxions conſidered in themſelves. In all this the general ultimate drift of the author is very clear, but his principles are obſcure. But perhaps thoſe theories of the great author are not minutely conſidered or canvaſſed by his diſciples: who ſeem eager, as was before hinted, rather to operate than to know, rather to apply his rules and his forms, than to underſtand his principles and enter into his notions. It is nevertheleſs certain, that in order to follow him in his quadratures, they muſt find fluents from fluxions; and in order to this, they muſt know to find fluxions from fluents; and in order to find fluxions, they muſt firſt know what fluxions are. Otherwiſe they proceed without clearneſs and without ſcience. Thus the direct method precedes the inverſe, and the knowledge of the principles is ſuppoſed in both. But as for operating according to rules, and by the help of general forms, whereof the original principles and reaſons are not underſtood, this is to be eſteemed merely technical. Be the principles therefore ever ſo abſtruſe and metaphyſical, they muſt be ſtudied by whoever would comprehend the doctrine of fluxions. Nor can any geometrician have a right to apply the rules of the great author, without firſt conſidering his metaphyſical notions whence they were derived. Theſe how neceſſary ſoever in order to ſcience, which can never be attained without a preciſe, clear, and accurate conception of the principles, are nevertheleſs by ſeveral careleſly paſſed over; while the expreſſions alone are dwelt on and conſidered and treated with great ſkill and management, thence to obtain other expreſſions by methods, ſuſpicious and indirect (to ſay the leaſt) if conſidered in themſelves, however recommended by induction and authority; two motives which are acknowledged ſufficient to beget a rational faith and moral perſuaſion, but nothing higher.

XLVIII. You may poſſibly hope to evade the force of all that hath been ſaid, and to ſcreen falſe principles and inconſiſtent reaſonings, by a general pretence that theſe objections and remarks are metaphyſical. But this is a vain pretence. For the plain ſenſe and truth of what is advanced in the foregoing remarks, I appeal to the underſtanding of every unprejudiced intelligent reader. To the ſame I appeal, whether the points remarked upon are not moſt incomprehenſible metaphyſics. And metaphyſics not of mine, but your own. I would not be underſtood to infer, that your notions are falſe or vain becauſe they are metaphyſical. Nothing is either true or falſe for that reaſon. Whether a point be called metaphyſical or no, avails little. The queſtion is, whether it be clear or obſcure, right or wrong, well or ill-deduced?

XLIX. Although momentaneous increments, naſcent and evaneſcent quantities, fluxions and infiniteſimals of all degrees, are in truth ſuch ſhadowy entities, ſo difficult to imagine or conceive diſtinctly, that (to ſay the leaſt) they cannot be admitted as principles or objects of clear and accurate ſcience: and although this obſcurity and incomprehenſibility of your metaphyſics had been alone ſufficient to allay your pretenſions to evidence; yet it hath, if I miſtake not, been further ſhewn, that your inferences are no more juſt than your conceptions are clear, and that your logics are as exceptionable as your metaphyſics. It ſhould ſeem therefore upon the whole, that your concluſions are not attained by juſt reaſoning from clear principles; conſequently, that the employment of modern analyſts, however uſeful in mathematical calculations and conſtructions, doth not habituate and qualify the mind to apprehend clearly and infer juſtly; and conſequently, that you have no right in virtue of ſuch habits, to dictate out of your proper ſphere, beyond which your judgment is to paſs for no more than that of other men.

L. Of

L. Of a long time I have ſuſpected, that theſe modern analytics were not ſcientifical, and gave ſome hints thereof to the public about twenty-five years ago. Since which time, I have been diverted by other occupations, and imagined I might employ myſelf better than in deducing and laying together my thoughts on ſo nice a ſubject. And though of late I have been called upon to make good my ſuggeſtions; yet as the perſon, who made this call, doth not appear to think maturely enough to underſtand, either thoſe metaphyſics which he would refute, or mathematics which he would patronize, I ſhould have ſpared myſelf the trouble of writing for his conviction. Nor ſhould I now have troubled you or myſelf with this addreſs, after ſo long an intermiſſion of theſe ſtudies; were it not to prevent, ſo far as I am able, your impoſing on yourſelf and others in matters of much higher moment and concern. And to the end that you may more clearly comprehend the force and deſign of the foregoing remarks, and purſue them ſtill farther in your own meditations, I ſhall ſubjoin the following Queries.

Query 1. Whether the object of geometry be not the proportions of aſſignable extenſions? And whether there be any need of conſidering quantities either infinitely great or infinitely ſmall?

Qu. 2. Whether the end of geometry be not to meaſure aſſignable finite extenſion? And whether this practical view did not firſt put men on the ſtudy of geometry?

Qu. 3. Whether the miſtaking the object and end of geometry hath not created needleſs difficulties, and wrong purſuits in that ſcience?

Qu. 4. Whether men may properly be ſaid to proceed in a ſcientific method, without clearly conceiving the object they are converſant about, the end propoſed, and the method by which it is purſued?

Qu. 5. Whether it doth not ſuffice, that every aſſignable number of parts may be contained in ſome aſſignable magnitude? And whether it be not unneceſſary, as well as abſurd, to ſuppoſe that finite extenſion is infinitely diviſible?

Qu. 6. Whether the diagrams in a geometrical demonſtration are not to be conſidered as ſigns of all poſſible finite figures, of all ſenſible and imaginable extenſions or magnitudes of the ſame kind?

Qu. 7. Whether it be poſſible to free geometry from inſuperable difficulties and abſurdities, ſo long as either the abſtract general idea of extenſion, or abſolute external extenſion be ſuppoſed its true object?

Qu. 8. Whether the notions of abſolute time, abſolute place, and abſolute motion be not moſt abſtractedly metaphyſical? Whether it be poſſible for us to meaſure, compute, or know them?

Qu. 9. Whether mathematicians do not engage themſelves in diſputes and paradoxes, concerning what they neither do nor can conceive? And whether the doctrine of forces be not a ſufficient proof of this? *

Qu. 10. Whether in geometry it may not ſuffice to conſider aſſignable finite magnitude, without concerning ourſelves with infinity? And whether it would not be righter to meaſure large polygons having finite ſides, inſtead of curves, than to ſuppoſe curves are polygons of infinitefimal ſides, a ſuppoſition neither true nor conceivable?

Qu. 11. Whether many points, which are not readily aſſented to, are not nevertheleſs true? And whether thoſe in the two following Queries may not be of that number?

* See the Latin Treatiſe *De Motu.*

Qu.

Qu. 12. Whether it be poſſible, that we ſhould have had an idea or notion of extenſion prior to motion? Or whether if a man had never perceived motion, he would ever have known or conceived one thing to be diſtant from another?

Qu. 13. Whether geometrical quantity hath coexiſtent parts? And whether all quantity be not in a flux as well as time and motion?

Qu. 14. Whether extenſion can be ſuppoſed an attribute of a being immutable and eternal?

Qu. 15. Whether to decline examining the principles, and unravelling the methods uſed in mathematics, would not ſhew a bigotry in mathematicians?

Qu. 16. Whether certain maxims do not paſs current among analyſts, which are ſhocking to good ſenſe? And whether the common aſſumption that a finite quantity divided by nothing is infinite be not of this number?

Qu. 17. Whether the conſidering geometrical diagrams abſolutely or in themſelves, rather than as repreſentatives of all aſſignable magnitudes or figures of the ſame kind, be not a principal cauſe of the ſuppoſing finite extenſion infinitely diviſible; and of all the difficulties and abſurdities conſequent thereupon?

Qu. 18. Whether from geometrical propoſitions being general, and the lines in diagrams being therefore general ſubſtitutes or repreſentatives, it doth not follow that we may not limit or conſider the number of parts, into which ſuch particular lines are diviſible?

Qu.

Qu. 19. When it is ſaid or implied, that ſuch a certain line delineated on paper contains more than any aſſignable number of parts, whether any more in truth ought to be underſtood, than that it is a ſign indifferently repreſenting all finite lines, be they ever ſo great. In which relative capacity it contains, *i. e.* ſtands for more than any aſſignable number of parts? And whether it be not altogether abſurd to ſuppoſe a finite line, conſidered in itſelf or in its own poſitive nature, ſhould contain an infinite number of parts?

Qu. 20. Whether all arguments for the infinite diviſibility of finite extention do not ſuppoſe and imply, either general abſtract ideas or abſolute external extenſion to be the object of geometry? And therefore, whether, along with thoſe ſuppoſitions, ſuch arguments alſo do not ceaſe and vaniſh?

Qu. 21. Whether the ſuppoſed infinite diviſibility of finite extenſion hath not been a ſnare to mathematicians, and a thorn in their ſides? And whether a quantity infinitely diminiſhed and a quantity infinitely ſmall, are not the ſame thing?

Qu. 22. Whether it be neceſſary to conſider velocities of naſcent or evaneſcent quantities, or moments, or infiniteſimals? And whether the introducing of things ſo inconceivable be not a reproach to mathematicks?

Qu. 23. Whether inconſiſtencies can be truths? Whether points repugnant and abſurd are to be admitted upon any ſubject, or in any ſcience? And whether the uſe of infinites ought to be allowed, as a ſufficient pretext and apology for the admitting of ſuch points in geometry?

Qu.

Qu. 24. Whether a quantity be not properly ſaid to be known, when we know its proportion to given quantities? And whether this proportion can be known, but by expreſſions or exponents, either geometrical, algebraical, or arithmetical? And whether expreſſions in lines or ſpecies can be uſeful, but ſo far forth as they are reducible to numbers?

Qu. 25. Whether the finding out proper expreſſions or notations of quantity be not the moſt general character and tendency of the mathematicks? And arithmetical operation that which limits and defines their uſe?

Qu. 26. Whether mathematicians have ſufficiently conſidered the analogy and uſe of ſigns? And how far the ſpecific limited nature of things correſponds thereto?

Qu. 27. Whether becauſe, in ſtating a general caſe of pure Algebra, we are at full liberty to make a character denote, either a poſitive or a negative quantity, or nothing at all, we may, therefore, in a geometrical caſe, limited by hypotheſes and reaſonings from particular properties and relations of figures, claim the ſame licenſe?

Qu. 28. Whether the ſhifting of the hypotheſis, or (as we may call it) the *fallacia ſuppoſitionis* be not a ſophiſm, that far and wide infects the modern reaſonings, both in the mechanical philoſophy and in the abſtruſe and fine geometry?

Qu. 29. Whether we can form an idea or notion of velocity diſtinct from and excluſive of its meaſures, as we can of heat diſtinct from and excluſive of the degrees on the thermometer, by which it is meaſured? And whether this be not ſuppoſed in the reaſonings of modern analyſts?

Qu.

Qu. 30. Whether motion can be conceived in a point of ſpace? And if motion cannot, whether velocity can? And if not, whether a firſt or laſt velocity can be conceived in a mere limit; either initial or final, of the deſcribed ſpace?

Qu. 31. Where there are no increments, whether there can be any *ratio* of increments? Whether nothings can be conſidered as proportional to real quantities? Or whether to talk of their proportions be not to talk nonſenſe? Alſo in what ſenſe we are to underſtand the proportion of a ſurface to a line, of an area to an ordinate? And whether ſpecies or numbers, though properly expreſſing quantities which are not homogeneous, may yet be ſaid to expreſs their proportion to each other?

Qu. 32. Whether if all aſſignable circles may be ſquared, the circle is not, to all intents and purpoſes, ſquared as well as the parabola? Or whether a parabolical area can in fact be meaſured more accurately than a circular?

Qu. 33. Whether it would not be righter to approximate fairly, than to endeavour at accuracy by ſophiſms?

Qu. 34. Whether it would not be more decent to proceed by trials and inductions, than to pretend to demonſtrate by falſe principles?

Qu. 35. Whether there be not a way of arriving at truth, although the principles are not ſcientific, nor the reaſoning juſt? And whether ſuch a way ought to be called a knack or a ſcience?

Qu. 36. Whether there can be ſcience of the concluſion, where there is not evidence of the principles? And whether a man can have evidence of the principles, without underſtanding them? And therefore, whether the

the mathematicians of the preſent age act like men of ſcience, in taking ſo much more pains to apply their principles, than to underſtand them?

Qu. 37. Whether the greateſt genius wreſtling with falſe principles may not be foiled? And whether accurate quadratures can be obtained without new *poſtulata* or aſſumptions? And if not, whether thoſe which are intelligible and conſiſtent ought not to be preferred to the contrary? *See* Sect. XXVIII. *and* XXIX.

Qu. 38. Whether tedious calculations in algebra and fluxions be the likelieſt method to improve the mind? And whether mens being accuſtomed to reaſon altogether about mathematical ſigns and figures, doth not make them at a loſs how to reaſon without them?

Qu. 39. Whether whatever readineſs analyſts acquire in ſtating a problem, or finding apt expreſſions for mathematical quantities, the ſame doth neceſſarily infer a proportionable ability in conceiving and expreſſing other matters?

Qu. 40. Whether it be not a general caſe or rule, that one and the ſame coefficient dividing equal products gives equal quotients? And yet whether ſuch coefficient can be interpreted by o or nothing? Or whether any one will ſay, that if the equation $2 \times o = 5 \times o$, be divided by o, the quotient on both ſides are equal? Whether therefore a caſe may not be general with reſpect to all quantities, and yet not extend to nothings, or include the caſe of nothing? And whether the bringing nothing under the notion of quantity may not have betrayed men into falſe reaſoning?

Qu. 41. Whether in the moſt general reaſonings about equalities and proportions, men may not demonſtrate as well as in geometry? Whether

in ſuch demonſtrations, they are not obliged to the ſame ſtrict reaſoning as in geometry? And whether ſuch their reaſonings are not deduced from the ſame axioms with thoſe in geometry? Whether therefore algebra be not as truly a ſcience as geometry?

Qu. 42. Whether men may not reaſon in ſpecies as well as in words? Whether the ſame rules of logic do not obtain in both caſes? And whether we have not a right to expect and demand the ſame evidence in both?

Qu. 43. Whether an algebraiſt, fluxioniſt, geometrician or demonſtrator of any kind can expect indulgence for obſcure principles or incorrect reaſonings? And whether an algebraical note, or ſpecies can at the end of a proceſs be interpreted in a ſenſe, which could not have been ſubſtituted for it at the beginning? Or whether any particular ſuppoſition can come under a general caſe which doth not conſiſt with the reaſoning thereof?

Qu. 44. Whether the difference between a mere computer and a man of ſcience be not, that the one computes on principles clearly conceived, and by rules evidently demonſtrated, whereas the other doth not?

Qu. 45. Whether, although geometry be a ſcience, and algebra allowed to be a ſcience, and the analytical a moſt excellent method, in the application nevertheleſs of the analyſis to geometry, men may not have admitted falſe principles and wrong methods of reaſoning?

Qu. 46. Whether, although algebraical reaſonings are admitted to be ever ſo juſt, when confined to ſigns or ſpecies as general repreſentatives of quantity, you may not nevertheleſs fall into error, if, when you limit them to ſtand for particular things, you do not limit yourſelf to reaſon conſiſtently

conſiſtently with the nature of ſuch particular things? And whether ſuch error ought to be imputed to pure Algebra?

Qu. 47. Whether the view of modern mathematicians doth not rather ſeem to be the coming at an expreſſion by artifice, than the coming at ſcience by demonſtration?

Qu. 48. Whether there may not be found metaphyſics as well as unfound? Sound as well as unfound logic? And whether the modern analytics may not be brought under one of theſe denominations, and which?

Qu. 49. Whether there be not really a *philoſophia prima*, a certain tranſcendental ſcience ſuperior to and more extenſive than mathematics, which it might behove our modern analyſts rather to learn than deſpiſe?

Qu. 50. Whether ever ſince the recovery of mathematical learning, there have not been perpetual diſputes and controverſies among the mathematicians? And whether this doth not diſparage the evidence of their methods?

Qu. 51. Whether any thing but metaphyſics and logic can open the eyes of mathematicians and extricate them out of their difficulties?

Qu. 52. Whether upon the received principles a quantity can by any diviſion or ſubdiviſion, though carried ever ſo far, be reduced to nothing?

Qu. 53. Whether if the end of geometry be practice, and this practice be meaſuring, and we meaſure only aſſignable extenſions, it will not follow that unlimited approximations completely anſwer the intention of geometry?

Qu. 54. Whether the ſame things which are now done by infinites may not be done by finite quantities? And whether this would not be a great relief to the imaginations and underſtandings of mathematical men?

Qu. 55. Whether thoſe philomathematical phyſicians, anatomiſts, and dealers in the animal œconomy, who admit the doctrine of fluxions with an implicit faith, can with a good grace inſult other men for believing what they do not comprehend?

Qu. 56. Whether the corpuſcularian, experimental, and mathematical philoſophy ſo much cultivated in the laſt age, hath not too much engroſſed mens attention; ſome part whereof it might have uſefully employed?

Qu. 57. Whether from this, and other concurring cauſes, the minds of ſpeculative men have not been born downward, to the debaſing and ſtupifying of the higher faculties? And whether we may not hence account for that prevailing narrowneſs and bigotry among many who paſs for men of ſcience, their incapacity for things moral, intellectual, or theological, their proneneſs to meaſure all truths by ſenſe and experience of animal life?

Qu. 58. Whether it be really an effect of thinking, that the ſame men admire the great author for his fluxions, and deride him for his religion?

Qu. 59. If certain philoſophical virtuoſi of the preſent age have no religion, whether it can be ſaid to be want of faith?

Qu. 60. Whether it be not a juſter way of reaſoning, to recommend points of faith from their effects, than to demonſtrate mathematical principles by their concluſions?

Qu.

Qu. 61. Whether it be not leſs exceptionable to admit points above reaſon than contrary to reaſon?

Qu. 62. Whether myſteries may not with better right be allowed of in divine faith, than in human ſcience?

Qu. 63. Whether ſuch mathematicians as cry out againſt myſteries, have ever examined their own principles?

Qu. 64. Whether mathematicians, who are ſo delicate in religious points, are ſtrictly ſcrupulous in their own ſcience? Whether they do not ſubmit to authority, take things upon truſt, believe points inconceivable? Whether they have not their myſteries, and what is more, their repugnancies and contradictions?

Qu. 65. Whether it might not become men, who are puzzled and perplexed about their own principles, to judge warily, candidly, and modeſtly concerning other matters?

Qu. 66. Whether the modern analytics do not furniſh a ſtrong *argumentum ad hominem*, againſt the philomathematical infidels of theſe times?

Qu. 67. Whether it follows from the abovementioned remarks, that accurate and juſt reaſoning is the peculiar character of the preſent age? And whether the modern growth of infidelity can be aſcribed to a diſtinction ſo truly valuable?

A

DEFENCE

OF

FREE-THINKING

IN

MATHEMATICS.

IN ANSWER

To a Pamphlet of PHILALETHES CANTABRIGIENSIS, intitled, *Geometry no Friend to Infidelity, or a Defence of Sir* ISAAC NEWTON, *and the* Britiſh *Mathematicians.*

ALSO,

An APPENDIX concerning Mr. WALTON's *Vindication of the Principles of Fluxions againſt the Objections contained in the* ANALYST.

WHEREIN

It is attempted to put this Controverſy in ſuch a Light as that every Reader may be able to judge thereof.

A DEFENCE OF FREE-THINKING IN MATHEMATICS, &c.

I. WHEN I read your defence of the *Britiſh* mathematicians, I could not, Sir, but admire your courage in aſſerting with ſuch undoubting aſſurance things ſo eaſily diſproved. This to me ſeemed unaccountable, till I reflected on what you ſay (*P.* 32) when upon my having appealed to every thinking reader, whether it be poſſible to frame any clear conception of fluxions, you expreſs yourſelf in the following manner, " Pray, Sir, who are thoſe thinking readers you appeal to? Are they " geometricians or perſons wholly ignorant of geometry? If the former " I leave it to them: if the latter, I aſk how well are they qualified to " judge of the method of fluxions?" It muſt be acknowledged you ſeem by this dilemma ſecure in the favour of one part of your readers, and the ignorance of the other. I am nevertheleſs perſuaded there are fair and candid men among the mathematicians. And for thoſe who are not mathematicians, I ſhall endeavour ſo to unveil this myſtery, and put the controverſy between us in ſuch a light, as that every reader of ordinary ſenſe and reflection may be a competent judge thereof.

II. "You expreſs an extreme ſurprize and concern, that I ſhould take "ſo much pains to depreciate one of the nobleſt ſciences, to diſparage "and traduce a ſet of learned men whoſe labours ſo greatly conduce to "the honour of this iſland (*P.* 5), to leſſen the reputation and authority "of Sir *Iſaac Newton* and his followers, by ſhewing that they are not "ſuch maſters of reaſon as they are generally preſumed to be; and to "depreciate the ſcience they profeſs, by demonſtrating to the world, "that it is not of that clearneſs and certainty as is commonly imagined. "All which, you inſiſt, appears very ſtrange to you and the reſt of that "famous Univerſity, who plainly ſee of how great uſe mathematical "learning is to mankind." Hence you take occaſion to declaim on the uſefulneſs of mathematics in the ſeveral branches, and then to redouble your ſurprize and amazement (*P.* 19 and 20). To all which declamation I reply that it is quite beſide the purpoſe. For I allow, and always have allowed, its full claim of merit to whatever is uſeful and true in the mathematics: but that which is not ſo, the leſs it employs men's time and thoughts, the better. And after all you have ſaid or can ſay, I believe the unprejudiced reader will think with me, that things obſcure are not therefore ſacred; and that it is no more a crime, to canvaſs and detect unſound principles or falſe reaſonings in mathematics, than in any other part of learning.

III. You are, it ſeems, much at a loſs to underſtand the uſefulneſs or tendency or prudence of my attempt. I thought I had ſufficiently explained this in the Analyſt. But for your further ſatisfaction ſhall here tell you, it is very well known, that ſeveral perſons who deride faith and myſteries in religion, admit the doctrine of fluxions for true and certain. Now if it be ſhewn that fluxions are really moſt incomprehenſible myſteries, and that thoſe, who believe them to be clear and ſcientific, do entertain an implicit faith in the author of that method; will not this furniſh a fair *argumentum ad hominem* againſt men, who reject that very thing

thing in religion which they admit in human learning? And is it not a proper way to abate the pride, and diſcredit the pretenſions of thoſe, who inſiſt upon clear ideas in points of faith, if it be ſhewn that they do without them even in ſcience?

IV. As to my timing this charge; why now and not before, ſince I had publiſhed hints thereof many years ago? Surely I am obliged to give no account of this: if what hath been ſaid in the Analyſt be not ſufficient; ſuppoſe that I had not leiſure, or that I did not think it expedient, or that I had no mind to it. When a man thinks fit to publiſh any thing, either in mathematics, or in any other part of learning; what avails it, or indeed what right hath any one to aſk, why at this or that time; in this or that manner; upon this or that motive? Let the reader judge, if it ſuffice not, that what I publiſh is true, and that I have a right to publiſh ſuch truths, when and how I pleaſe in a free country.

V. I do not ſay, that mathematicians, as ſuch, are infidels; or that geometry is a friend to infidelity, which you untruly inſinuate, as you do many other things; whence you raiſe topics for invective: but I ſay there are certain mathematicians, who are known to be ſo; and that there are others, who are not mathematicians, who are influenced by a regard for their authority. Some perhaps, who live in the Univerſity, may not be appriſed of this; but the intelligent and obſerving reader, who lives in the world, and is acquainted with the humour of the times, and the characters of men, is well aware, there are too many that deride myſteries, and yet admire fluxions; who yield that faith to a mere mortal, which they deny to *Jeſus Chriſt*, whoſe religion they make it their ſtudy and buſineſs to diſcredit. The owning this is not to own, that men who reaſon well, are enemies to religion, as you would repreſent it: on the contrary, I endeavour to ſhew, that ſuch men are defective in

point of reaſon and judgment, and that they do the very thing they would ſeem to deſpiſe.

VI. There are, I make no doubt, among the mathematicians many ſincere believers in *Jeſus Chriſt*; I know ſeveral ſuch myſelf; but I addreſſed my Analyſt to an infidel; and on very good grounds, I ſuppoſed that beſides him, there were other deriders of faith, who had nevertheleſs a profound veneration for fluxions; and I was willing to ſet forth the inconſiſtence of ſuch men. If there be no ſuch thing as infidels, who pretend to knowledge in the modern analyſis, I own myſelf miſinformed, and ſhall gladly be found in a miſtake; but even in that caſe, my remarks upon fluxions are not the leſs true; nor will it follow, that I have no right to examine them on the foot of human ſcience, even though religion were quite unconcerned, and though I had no end to ſerve but truth. But you are very angry (*P.* 13 and 14) that I ſhould enter the liſts with reaſoning infidels, and attack them upon their pretenſions to ſcience: and hence you take occaſion to ſhew your ſpleen againſt the clergy. I will not take upon me to ſay, that I know you to be a minute philoſopher yourſelf: but I know, the minute philoſophers make juſt ſuch compliments as you do to our church, and are juſt as angry as you can be at any, who undertake to defend religion by reaſon. If we reſolve all into faith, they laugh at us and our faith: and if we attempt to reaſon, they are angry at us: they pretend we go out of our province, and they recommend to us a blind implicit faith. Such is the inconſiſtence of our adverſaries. But it is to be hoped, there will never be wanting men to deal with them at their own weapons; and to ſhew, they are by no means thoſe maſters of reaſon, which they would fain paſs for.

VII. I do not ſay, as you would repreſent me, that we have no better reaſon for our religion, than you have for fluxions: but I ſay, that an infidel, who believes the doctrine of fluxions, acts a very inconſiſtent part,

part, in pretending to reject the chriſtian religion, becauſe he cannot believe what he doth not comprehend; or becauſe he cannot aſſent without evidence; or becauſe he cannot ſubmit his faith to authority. Whether there are ſuch infidels, I ſubmit to the judgment of the reader; for my own part I make no doubt of it, having ſeen ſome ſhrewd ſigns thereof myſelf, and having been very credibly informed thereof by others. Nor doth this charge ſeem the leſs credible, for your being ſo ſenſibly touched, and denying it with ſo much paſſion. You, indeed, do not ſtick to affirm, that the perſons who informed me are *a pack of baſe profligate and impudent liars* (*P.* 27). How far the reader will think fit to adopt your paſſions I cannot ſay; but I can truly ſay, the late celebrated Mr. *Addiſon* is one of the perſons, whom you are pleaſed to characterize in thoſe modeſt and mannerly terms. He aſſured me that the infidelity of a certain noted mathematician, ſtill living, was one principal reaſon aſſigned by a witty man of thoſe times for his being an infidel. Not, that I imagine geometry diſpoſeth men to infidelity: but that from other cauſes, ſuch as preſumption, ignorance, or vanity, like other men geometricians alſo become infidels, and that the ſuppoſed light and evidence of their ſcience gains credit to their infidelity.

VIII. "You reproach me with calumny, detraction, and artifice (*P.* 15). "You recommend ſuch means as are innocent and juſt, rather than the "criminal method of leſſening or detracting from my opponents (*ibid.*) "You accuſe me of the *odium theologicum*, the intemperate zeal of divines, "that I do *ſtare ſuper vias antiquas*," (*P.* 13) with much more to the ſame effect. For all which charge I depend on the reader's candour, that he will not take your word, but read and judge for himſelf. In which caſe he will be able to diſcern (though he ſhould be no mathematician) how paſſionate and unjuſt your reproaches are, and how poſſible it is, for a man to cry out againſt calumny and practiſe it in the ſame breath. Conſidering how impatient all mankind are when their prejudices are looked

looked into, I do not wonder to ſee you rail and rage at the rate you do. But if your own imagination be ſtrongly ſhocked and moved, you cannot therefore conclude, that a ſincere endeavour to free a ſcience, ſo uſeful and ornamental to human life, from thoſe ſubtilties, obſcurities, and paradoxes which render it inacceſſible to moſt men, will be thought a criminal undertaking by ſuch as are in their right mind. Much leſs can you hope that an illuſtrious ſeminary of learned men, which hath produced ſo many free-ſpirited inquirers after truth, will at once enter into your paſſions and degenerate into a neſt of bigots.

IX. I obſerve upon the inconſiſtency of certain infidel analyſts. I remark ſome defects in the principles of the modern analyſis. I take the liberty decently to diſſent from Sir *Iſaac Newton*. I propoſe ſome helps to abridge the trouble of mathematical ſtudies and render them more uſeful. What is there in all this that ſhould make you declaim on the uſefulneſs of practical mathematics? That ſhould move you to cry out *Spain*, *inquiſition*, *odium theologicum?* By what figure of ſpeech, do you extend, what is ſaid of the modern analyſis, to mathematics in general, or what is ſaid of mathematical infidels to all mathematicians, or the confuting an error in ſcience to burning or hanging the authors? But it is nothing new or ſtrange, that men ſhould chooſe to indulge their paſſions, rather than quit their opinions how abſurd ſoever. Hence the frightful viſions and tragical uproars of bigoted men, be the ſubject of their bigotry what it will. A very remarkable inſtance of this you give (*P.* 27) where, upon my having ſaid that a deference to certain mathematical infidels, as I was credibly informed, had been one motive to infidelity, you aſk with no ſmall emotion, " For God's ſake are we in *England* or in *Spain?* Is " this the language of a familiar who is whiſpering an inquiſitor, *&c?*" And the page before you exclaim in the following words. " Let us burn " or hang up all the mathematicians in *Great Britain*, or halloo the mob " upon them to tear them to pieces every mother's ſon of them, *Tros ru-*

" *tuluſve*

" *tuluſve ſuat*, laymen or clergymen, *&c.* Let us dig up the bodies of " Dr. *Barrow* and Sir *Iſaac Newton*, and burn them under the gallows, " *&c.*"

X. The reader need not be a mathematician, to ſee how vain all this tragedy of yours is. And if he be as thoroughly ſatisfied as I am, that the cauſe of fluxions cannot be defended by reaſon, he will be as little ſurpriſed as I am, to ſee you betake yourſelf to the arts of all bigoted men, raiſing terror and calling in the paſſions to your aſſiſtance. Whether thoſe rhetorical flouriſhes about the inquiſition and the gallies are not quite ridiculous, I leave to be determined by the reader. Who will alſo judge (though he ſhould not be ſkilled in geometry) whether I have given the leaſt grounds, for this and a world of ſuch like declamation? And whether I have not conſtantly treated thoſe celebrated writers, with all proper reſpect, though I take the liberty in certain points to differ from them?

XI. As I heartily abhor an inquiſition in faith, ſo I think you have no right to erect one in ſcience. At the time of writing your defence you ſeem to have been overcome with paſſion: but now you may be ſuppoſed cool, I deſire you to reflect whether it be not wrote in the true ſpirit of an inquiſitor. Whether this becomes a perſon ſo exceeding delicate himſelf upon that point? And whether your brethren the Analyſts will think themſelves honoured or obliged by you, for having defended their doctrine, in the ſame manner as any declaiming bigot would defend tranſubſtantiation? The ſame falſe colours, the ſame intemperate ſallies, and the ſame indignation againſt common ſenſe!

XII. In a matter of mere ſcience, where authority hath nothing to do, you conſtantly endeavour to overbear me with authorities, and load me with envy. If I ſee a ſophiſm in the writings of a great author, and, in complement

complement to his underſtanding, ſuſpect he could hardly be quite ſatisfied with his own demonſtration: this ſets you on declaiming for ſeveral pages. It is pompouſly ſet forth as a criminal method of detracting from great men, as a concerted project to leſſen their reputation, as making them paſs for impoſtors. If I publiſh my free thoughts, which I have as much right to publiſh as any other man, it is imputed to raſhneſs and vanity and the love of oppoſition. Though perhaps my late publication, of what had been hinted twenty-five years ago, may acquit me of this charge in the eyes of an impartial reader. But when I conſider the perplexities that beſet a man, who undertakes to defend the doctrine of fluxions, I can eaſily forgive your anger.

XIII. Two ſorts of learned men there are: one, who candidly ſeek truth by rational means. Theſe are never averſe to have their principles looked into, and examined by the teſt of reaſon. Another ſort there is who learn by *rote* a ſet of principles and a way of thinking which happen to be in vogue. Theſe betray themſelves by their anger and ſurpriſe, whenever their principles are freely canvaſſed. But you muſt not expect, that your reader will make himſelf a party to your paſſions or your prejudices. I freely own that Sir *Iſaac Newton* hath ſhewed himſelf an extraordinary mathematician, a profound naturaliſt, a perſon of the greateſt abilities and erudition. Thus far I can readily go, but I cannot go to the lengths that you do. I ſhall never ſay of him as you do, *Veſtigia pronus adoro* (*P.* 70). This ſame adoration that you pay to him, I will pay only to truth.

XIV. You may, indeed, yourſelf be an idolater of whom you pleaſe: but then you have no right to inſult and exclaim at other men, becauſe they do not adore your idol. Great as Sir *Iſaac Newton* was, I think he hath, on more occaſions than one, ſhewed himſelf not to be infallible. Particularly, his demonſtration of the doctrine of fluxions I take to be defective,

defective, and I cannot help thinking that he was not quite pleaſed with it himſelf. And yet this doth not hinder but the method may be uſeful, conſidered as an art of invention. You, who are a mathematician, muſt acknowledge, there have been divers ſuch methods admitted in mathematics, which are not demonſtrative. Such, for inſtance, are the inductions of Doctor *Wallis* in his Arithmetic of Infinites, and ſuch, what *Harriot* and, after him, *Deſcartes* have wrote concerning the roots of affected æquations. It will not, nevertheleſs, thence follow that thoſe methods are uſeleſs; but only, that they are not to be allowed of as premiſes in a ſtrict demonſtration.

XV. No great name upon earth ſhall ever make me accept things obſcure for clear, or ſophiſms for demonſtrations. Nor may you ever hope to deter me from freely ſpeaking what I freely think, by thoſe arguments *ab invidia* which at every turn you employ againſt me. You repreſent yourſelf (*P.* 52) as a man, *whoſe higheſt ambition is in the loweſt degree to imitate Sir* Iſaac Newton. It might, perhaps, have ſuited better with your appellation of *Philalethes*, and been altogether as laudable, if your higheſt ambition had been to diſcover truth. Very conſiſtently with the character you give of yourſelf, you ſpeak of it as a ſort of crime (*P.* 70) to think it poſſible, you ſhould ever *ſee further, or go beyond Sir* Iſaac Newton. And I am perſuaded you ſpeak the ſentiments of many more beſides yourſelf. But there are others who are not afraid to ſift the principles of human ſcience, who think it no honour to imitate the greateſt man in his defects, who even think it no crime to deſire to know, not only beyond Sir *Iſaac Newton*, but beyond all mankind. And whoever thinks otherwiſe, I appeal to the reader, whether he can properly be called a philoſopher.

XVI. Becauſe I am not guilty of your mean idolatry, you inveigh againſt me as a perſon conceited of my own abilities; not conſidering

that a perſon of leſs abilities may know more on a certain point than one of greater; not conſidering that a purblind eye, in a cloſe and narrow view, may diſcern more of a thing, than a much better eye in a more extenſive proſpect; not conſidering that this is to fix a *ne plus ultra*, to put a ſtop to all future inquiries; laſtly, not conſidering that this is in fact, ſo much as in you lies, converting the republic of letters into an abſolute monarchy, that it is even introducing a kind of philoſophic popery among a free people.

XVII. I have ſaid (and I venture ſtill to ſay) that a fluxion is incomprehenſible: that ſecond, third and fourth fluxions are yet more incomprehenſible: that it is not poſſible to conceive a ſimple infiniteſimal, that it is yet leſs poſſible to conceive an infiniteſimal of an infiniteſimal, and ſo onward *. What have you to ſay in anſwer to this? Do you attempt to clear up the notion of a fluxion or a difference? Nothing like it; "you only aſſure me (upon your bare word) from your own experience, "and that of ſeveral others whom you could name, that the doctrine of "fluxions may be clearly conceived and diſtinctly comprehended; and "that if I am puzzled about it and do not underſtand it, yet others do." But can you think, Sir, I ſhall take your word when I refuſe to take your maſter's?

XVIII. Upon this point every reader of common ſenſe may judge as well as the moſt profound mathematician. The ſimple apprehenſion of a thing defined is not made more perfect by any ſubſequent progreſs in mathematics. What any man evidently knows, he knows as well as you or Sir *Iſaac Newton*. And every one can know whether the object of this method be (as you would have us think) clearly conceivable. To judge of this, no depth of ſcience is requiſite, but only a bare attention to what paſſes in his own mind. And the ſame is to be underſtood of

* *Analyſt*, Sect. 4, 5, 6, &c.

all

all definitions in all ſciences whatſoever. In none of which can it be ſuppoſed, that a man of ſenſe and ſpirit will take any definition or principle upon truſt, without ſifting it to the bottom, and trying how far he can or he cannot conceive it. This is the courſe I have taken and ſhall take, however you and your brethren may declaim againſt it, and place it in the moſt invidious light.

XIX. It is uſual with you to admoniſh me to look over a ſecond time, to conſult, examine, weigh the words of Sir *Iſaac*. In anſwer to which I will venture to ſay, that I have taken as much pains as (I ſincerely believe) any man living, to underſtand that great author and to make ſenſe of his principles. No induſtry nor caution nor attention, I aſſure you, have been wanting on my part. So that, if I do not underſtand him, it is not my fault but my misfortune. Upon other ſubjects you are pleaſed to compliment me with depth of thought and uncommon abilities (*P.* 5 and 84). But I freely own, I have no pretence to thoſe things. The only advantage I pretend to, is that I have always thought and judged for myſelf. And, as I never had a maſter in mathematics, ſo I fairly followed the dictates of my own mind in examining, and cenſuring the authors I read upon that ſubject, with the ſame freedom that I uſed upon any other; taking nothing upon truſt, and believing that no writer was infallible. And a man of moderate parts, who takes this painful courſe in ſtudying the principles of any ſcience, may be ſuppoſed to walk more ſurely than thoſe of greater abilities, who ſet out with more ſpeed and leſs care.

XX. What I inſiſt on is, that the idea of a fluxion ſimply conſidered is not at all improved or amended by any progreſs, though ever ſo great, in the analyſis: neither are the demonſtrations of the general rules of that method at all cleared up by applying them. The reaſon of which is, becauſe in operating or calculating, men do not return to contemplate

the original principles of the method, which they conſtantly preſuppoſe, but are employed in working, by notes and ſymbols, denoting the fluxions ſuppoſed to have been at firſt explained, and according to rules ſuppoſed to have been at firſt demonſtrated. This I ſay to encourage thoſe, who are not far gone in theſe ſtudies, to uſe intrepidly their own judgment, without a blind or a mean deference to the beſt of mathematicians, who are no more qualified than they are, to judge of the ſimple apprehenſion, or the evidence of what is delivered in the firſt elements of the method; men by further and frequent uſe or exerciſe becoming only more accuſtomed to the ſymbols and rules, which doth not make either the foregoing notions more clear, or the foregoing proofs more perfect. Every reader of common ſenſe, that will but uſe his faculties, knows as well as the moſt profound Analyſt what idea he frames or can frame of velocity without motion, or of motion without extenſion, of magnitude which is neither finite nor infinite, or of a quantity having no magnitude which is yet diviſible, of a figure where there is no ſpace, of proportion between nothings, or of a real product from nothing multiplied by ſomething. He need not be far gone in geometry to know, that obſcure principles are not to be admitted in demonſtration: that if a man deſtroys his own hypotheſis, he at the ſame time deſtroys what was built upon it: that error in the premiſes, not rectified, muſt produce error in the concluſion.

XXI. In my opinion the greateſt men have their prejudices. Men learn the elements of ſcience from others: and every learner hath a deference more or leſs to authority, eſpecially the young learners, few of that kind caring to dwell long upon principles, but inclining rather to take them upon truſt: and things early admitted by repetition become familiar: and this familiarity at length paſſeth for evidence. Now to me it ſeems, there are certain points tacitly admitted by mathematicians, which are neither evident nor true. And ſuch points or principles ever mixing

mixing with their reaſonings do lead them into paradoxes and perplexities. If the great author of the fluxionary method was early imbued with ſuch notions, it would only ſhew he was a man. And if by vertue of ſome latent error in his principles a man be drawn into fallacious reaſonings, it is nothing ſtrange that he ſhould take them for true: and, nevertheleſs, if, when urged by perplexities and uncouth conſequences, and driven to arts and ſhifts, he ſhould entertain ſome doubt thereof, it is no more than one may naturally ſuppoſe, might befall a great genius grappling with an inſuperable difficulty: which is the light in which I have placed Sir *Iſaac Newton* *. Hereupon you are pleaſed to remark, that I repreſent the great authot not only as a weak but an ill man, as a deceiver and an impoſtor. The reader will judge how juſtly.

XXII. As to the reſt of your colourings and gloſſes, your reproaches and inſults and outcries, I ſhall paſs them over, only deſiring the reader not to take your word, but read what I have written, and he will want no other anſwer. It hath been often obſerved that the worſt cauſe produceth the greateſt clamour, and indeed you are ſo clamorous throughout your defence that the reader, although he ſhould be no mathematician, provided he underſtands common ſenſe and hath obſerved the ways of men, will be apt to ſuſpect that you are in the wrong. It ſhould ſeem, therefore, that your brethren the Analyſts are but little obliged to you, for this new method of declaiming in mathematics. Whether they are more obliged by your reaſoning I ſhall now examine.

XXIII. You aſk me (*P.* 32) where I find Sir *Iſaac Newton* uſing ſuch expreſſions as the velocities of velocities, the ſecond, third, and fourth velocities, *&c.* This you ſet forth as a pious fraud and unfair repreſentation. I anſwer, that if according to Sir *Iſaac Newton* a fluxion be the velocity of an increment, then according to him I may call the fluxion

* *Analyſt*, Sect. xviii.

of

of a fluxion the velocity of a velocity. But for the truth of the antecedent ſee his introduction to the Quadrature of Curves, where his own words are, *motuum vel incrementorum velocitates nominando fluxiones.* See alſo the ſecond lemma of the ſecond book of his mathematical principles of natural philoſophy, where he expreſſeth himſelf in the following manner, *velocitates incrementorum ac decrementorum quas etiam, motus, mutationes & fluxiones quantitatum nominare licet.* And that he admits fluxions of fluxions, or ſecond, third, fourth fluxions, *&c.* ſee his Treatiſe of the Quadrature of Curves. I aſk now, is it not plain, that if a fluxion be a velocity, then the fluxion of a fluxion may agreeably thereunto be called the velocity of a velocity? In like manner if by a fluxion is meant a naſcent augment, will it not then follow, that the fluxion of a fluxion or ſecond fluxion is the naſcent augment of a naſcent augment? Can any thing be plainer. Let the reader now judge who is unfair.

XXIV. I had obſerved, that the great author had proceeded illegitimately, in obtaining the fluxion or moment of the rectangle of two flowing quantities; and that he did not fairly get rid of the rectangle of the moments. In anſwer to this you alledge, that the error ariſing from the omiſſion of ſuch rectangle (allowing it to be an error) is ſo ſmall that it is inſignificant. This you dwell upon and exemplify to no other purpoſe, but to amuſe your reader and miſlead him from the queſtion; which in truth is not concerning the accuracy of computing or meaſuring in practice, but concerning the accuracy of the reaſoning in ſcience. That this was really the caſe, and that the ſmallneſs of the practical error no wiſe concerns it, muſt be ſo plain to any one who reads the Analyſt, that I wonder how you could be ignorant of it.

XXV. You would fain perſuade your reader, that I make an abſurd quarrel againſt errors of no ſignificancy in practice, and repreſent mathematicians

thematicians as proceeding blindfold in their approximations, in all which I cannot help thinking there is on your part either great ignorance or great diſingenuity. If you mean to defend the reaſonableneſs and uſe of approximations or of the method of indiviſibles, I have nothing to ſay. But then you muſt remember this is not the doctrine of fluxions: it is none of that analyſis with which I am concerned. That I am far from quarrelling at approximations in geometry is manifeſt from the thirty third and fifty third Queries in the Analyſt. And that the method of fluxions pretends to ſomewhat more than the method of indiviſibles is plain; becauſe Sir *Iſaac* diſclaims this method as not geometrical *. And that the method of fluxions is ſuppoſed accurate in geometrical rigour is manifeſt, to whoever conſiders what the great author writes about it; eſpecially in his introduction to the Quadrature of Curves, where he ſaith, *In rebus mathematicis errores quam minimi non ſunt contemnendi.* Which expreſſion you have ſeen quoted in the Analyſt, and yet you ſeem ignorant thereof, and indeed, of the very end and deſign of the great author in this his invention of fluxions.

XXVI. As oft as you talk of finite quantities inconſiderable in practice, Sir *Iſaac* diſowns your apology. *Cave*, ſaith he, *intellexeris finitas.* And although quantities leſs than ſenſible may be of no account in practice, yet none of your maſters, nor will even you yourſelf venture to ſay, they are of no account in theory and in reaſoning. The application in groſs practice is not the point queſtioned, but the rigour and juſtneſs of the reaſoning. And it is evident that, be the ſubject ever ſo little, or ever ſo inconſiderable, this doth not hinder but that a perſon treating thereof may commit very great errors in logic, which logical errors are in no wiſe to be meaſured by the ſenſible or practical inconveniences thence ariſing, which, perchance may be none at all. It muſt be own-

* See the Scholium at the end of the firſt Section. Lib. 1. Phil. Nat. Prin. Math.

ed,

ed, that after you have miſlead and amuſed your leſs qualified reader (as you call him) you return to the real point in controverſy, and ſet yourſelf to juſtify Sir *Iſaac*'s method of getting rid of the above-mentioned rectangle. And here I muſt intreat the reader to obſerve how fairly you proceed.

XXVII. Firſt then you affirm (*P.* 44) " that, neither in the demon- " ſtration of the rule for finding the fluxion of the rectangle of two " flowing quantities, nor in any thing preceding or following it, is any " mention ſo much as once made of the increment of the rectangle of " ſuch flowing quantities." Now I affirm the direct contrary. For in the very paſſage by you quoted in this ſame page, from the firſt caſe of the ſecond lemma of the ſecond book of Sir *Iſaac*'s principles, beginning with *Rectangulum quodvis motu perpetuo auctum*, and ending with *igitur laterum incrementis totis a et b generatur rectanguli incrementum a B x b A Q. E. D.* In this very paſſage I ſay is expreſs mention made of the increment of ſuch rectangle. As this is matter of fact, I refer it to the reader's own eyes. Of what rectangle have we here the increment? Is it not plainly of that whoſe ſides have *a* and *b* for their *incrementa tota*, that is, of *A B*. Let any reader judge whether it be not plain from the words, the ſenſe, and the context, that the great author in the end of his demonſtration underſtands his *incrementum* as belonging to the *rectangulum quodvis* at the beginning. Is not the ſame alſo evident from the very lemma itſelf prefixed to the demonſtration? The ſenſe whereof is (as the author there explains it) that if the moments of the flowing quantities *A* and *B* are called *a* and *b*, then the *momentum vel mutatio geniti rectanguli A B* will be *a B x b A*. Either therefore the concluſion of the demonſtration is not the thing which was to be demonſtrated, or the *rectanguli incrementum a B x b A* belongs to the rectangle *A B*.

XXVIII.

XXVIII. All this is ſo plain that nothing can be more ſo; and yet you would fain perplex this plain caſe by diſtinguiſhing between an increment and a moment. But it is evident to every one, who has any notion of demonſtration, that the *incrementum* in the concluſion muſt be the *momentum* in the lemma; and to ſuppoſe it otherwiſe is no credit to the author. It is in effect ſuppoſing him to be one who did not know what he would demonſtrate. But let us hear Sir *Iſaac*'s own words: *Earum (quantitatum ſcilicet fluentium) incrementa vel decrementa momentanea ſub nomine momentorum intelligo.* And you obſerve yourſelf that he uſeth the word *moment* to ſignify either an increment or decrement. Hence with an intention to puzzle me you propoſe the increment and decrement of AB, and aſk which of theſe I would call the moment? The caſe you ſay is difficult. My anſwer is very plain and eaſy, to wit, either of them. You, indeed, make a different anſwer, and from the author's ſaying that, by a moment he underſtands either the momentaneous increment or decrement of the flowing quantities, you would have us conclude, by a very wonderful inference, that his moment is neither the increment nor decrement thereof. Would it not be as good an inference, becauſe a number is either odd or even, to conclude it is neither? Can any one make ſenſe of this? Or can even yourſelf hope that this will go down with the reader, how little ſoever qualified? It muſt be owned, you endeavour to obtrude this inference on him, rather by mirth and humour than by reaſoning. You are merry, I ſay, and (*P.* 46), repreſent the two mathematical quantities as pleading their rights, as toſſing up croſs and pile, as diſputing amicably. You talk of their claiming preference, their agreeing, their boyiſhneſs and their gravity. And after this ingenious digreſſion you addreſs me in the following words —Believe me there is no remedy, you muſt acquieſce. But my anſwer is that I will neither believe you nor acquieſce; there is a plain remedy in common ſenſe; and that to prevent ſurpriſe I deſire the reader always to keep the controverted point in view, to examine your reaſons, and

be cautious how he takes your word, but moſt of all when you are poſitive or eloquent or merry.

XXIX. A page or two after, you very candidly repreſent your caſe to be that of an aſs between two bottles of hay: it is your own expreſſion. The cauſe of your perplexity is that you know not, whether the velocity of AB increaſing or of AB decreaſing is to be eſteemed the fluxion, or proportional to the moment of the rectangle. My opinion, agreeably to what hath been premiſed, is that either may be deemed the fluxion. But you tell us (*P.* 49) " that you think, the venerable ghoſt of Sir *Iſaac* " *Newton* whiſpers you, the velocity you ſeek for is neither the one nor " the other of theſe, but is the velocity which the flowing rectangle hath, " not while it is greater or leſs than AB, but at that very inſtant of " time that it is AB." For my part, in the rectangle AB conſidered ſimply in itſelf, without either increaſing or diminiſhing I can conceive no velocity at all. And if the reader is of my mind, he will not take either your word, or even the word of a ghoſt how venerable ſoever, for velocity without motion. You proceed and tell us that, in like manner, the moment of the rectangle is neither its increment or decrement. This you would have us believe on the authority of his ghoſt, in direct oppoſition to what Sir *Iſaac* himſelf aſſerted when alive. *Incrementa* (ſaith he) *vel decrementa momentanea ſub nomine momentorum intelligo: ita ut incrementa pro momentis additititis ſeu affirmativis, ac decrementa pro ſubductitiis ſeu negativis habeantur* *. I will not in your ſtyle bid the reader believe me, but believe his eyes.

XXX. To me it verily ſeems, that you have undertaken the defence of what you do not underſtand. To mend the matter, you ſay, " you " do not conſider AB as lying at either extremity of the moment, but " as extended to the middle of it; as having acquired the one half of

* Princip. Phil. Nat. Lib. II. Lem. II.

" the

" the moment, and as being about to acquire the other; or, as having " loſt one half of it, and being about to loſe the other." Now, in the name of truth, I intreat you to tell what this moment is, to the middle whereof the rectangle is extended? This moment, I ſay, which is acquired, which is loſt, which is cut in two, or diſtinguiſhed into halfs? Is it a finite quantity, or an infiniteſimal, or a mere limit, or nothing at all? Take it in what ſenſe you will, I cannot make your defence either conſiſtent or intelligible. For if you take it in either of the two former ſenſes, you contradict Sir *Iſaac Newton*. And if you take it in either of the latter, you contradict common ſenſe; it being plain, that what hath no magnitude, or is no quantity, cannot be divided. And here I muſt intreat the reader to preſerve his full freedom of mind intire, and not weakly ſuffer his judgment to be overborn by your imagination and your prejudices, by great names and authorities, by ghoſts and viſions, and above all by that extreme ſatisfaction and complacency with which you utter your ſtrange conceits; if words without a meaning may be called ſo. After having given this unintelligible account, you aſk with your accuſtomed air, " What ſay you, ſir? Is this a juſt and legitimate reaſon " for Sir *Iſaac*'s proceeding as he did? I think you muſt acknowledge it to " be ſo." But alas! I acknowledge no ſuch thing. I find no ſenſe or reaſon in what you ſay. Let the reader find it if he can.

XXXI. In the next place (*P.* 50) you charge me with want of caution. " Inaſmuch (ſay you) as that quantity which Sir *Iſaac Newton* " through his whole lemma, and all the ſeveral caſes of it, conſtantly " calls a *moment*, without confining it to be either an increment or decre- " ment, is by you inconſiderately and arbitrarily, and without any ſha- " dow of reaſon given, ſuppoſed and determined to be an increment." To which charge I reply that it is as untrue as it is peremptory. For that, in the foregoing citation from the firſt caſe of Sir *Iſaac*'s lemma, he expreſly determines it to be an increment. And as this particular in-

ſtance or paſſage was that which I objected to, it was reaſonable and proper for me to conſider the moment in that ſame light. But take it increment or decrement as you will, the objections ſtill lie and the difficulties are equally inſuperable. You then proceed to extol the great author of the fluxionary method, and to beſtow ſome *Bruſqueries* upon thoſe who unadviſedly dare to differ from him. To all which I ſhall give no anſwer.

XXXII. Afterwards to remove (as you ſay) all ſcruple and difficulty about this affair, you obſerve that the moment of the rectangle determined by Sir *Iſaac Newton*, and the increment of the rectangle determined by me, are perfectly and exactly equal, ſuppoſing *a* and *b* to be diminiſhed *ad infinitum:* and for proof of this, you refer to the firſt lemma of the firſt ſection of the firſt book of Sir *Iſaac*'s principles. I anſwer, that if *a* and *b* are real quantities, then *a b* is ſomethings, and conſequently makes a real difference: but if they are nothing, then the rectangles whereof they are coefficients become nothing likewiſe: and conſequently the *momentum* or *incrementum*, whether Sir *Iſaac*'s or mine, are in that caſe nothing at all. As for the abovementioned lemma, which you refer to, and which you wiſh I had conſulted ſooner, both for my own ſake and for yours; I tell you I had long ſince conſulted and conſidered it. But I very much doubt whether you have ſufficiently conſidered that lemma, its demonſtration and its conſequences. For, however that way of reaſoning may do in the method of *exhauſtions*, where quantities leſs than aſſignable are regarded as nothing; yet for a fluxioniſt writing about momentums, to argue that quantities muſt be equal becauſe they have no aſſignable difference, ſeems the moſt injudicious ſtep that could be taken: it is directly demoliſhing the very doctrine you would defend. For it will thence follow, that all homogeneous momentums are equal, and conſequently the velocities, mutations, or fluxions proportional thereto, are all likewiſe equal. There is, therefore, only

only one proportion of equality throughout, which at once overthrows the whole ſyſtem you undertake to defend. Your moments (I ſay) not being themſelves aſſignable quantities, their differences cannot be aſſignable: and if this be true, by that way of reaſoning it will follow, they are all equal, upon which ſuppoſition you cannot make one ſtep in the method of fluxions. It appears from hence, how unjuſtly you blame me (*P.* 32) for omitting to give any account of that firſt ſection of the firſt book of the *Principia*, wherein (you ſay) the foundation of the method of fluxions is geometrically demonſtrated and largely explained, and difficulties and objections againſt it are clearly ſolved. All which is ſo far from being true, that the very firſt and fundamental lemma of that ſection is incompatible with, and ſubverſive of the doctrine of fluxions. And, indeed, who ſees not that a demonſtration *ad abſurdum more veterum* proceeding on a ſuppoſition, that every difference muſt be ſome given quantity, cannot be admitted in, or conſiſt with, a method, wherein quantities, leſs than any given, are ſuppoſed really to exiſt, and be capable of diviſion?

XXXIII. The next point you undertake to defend is that method for obtaining a rule to find the fluxion of any power of a flowing quantity, which is delivered in his introduction to the Quadratures, and conſidered in the Analyſt *. And here the queſtion between us is, whether I have rightly repreſented the ſenſe of thoſe words, *evaneſcant jam augmenta illa*, in rendering them, let the increments vaniſh, *i. e.* let the increments be nothing, or let there be no increments? This you deny, but, as your manner is, inſtead of giving a reaſon you declaim. I, on the contrary affirm, the increments muſt be underſtood to be quite gone and abſolutely nothing at all. My reaſon is, becauſe without that ſuppoſition you can never bring the quantity or expreſſion $nx^{n-1} + \frac{nn-n}{2}ox^{n-2} +$

* Sect. 13, 14, &c.

&c. down to $n\dot{x}^{n-1}$, the very thing aimed at by ſuppoſing the evaneſcence. Say whether this be not the truth of the caſe? Whether the former expreſſion is not to be reduced to the latter? And whether this can poſſibly be done ſo long as o is ſuppoſed a real quantity? I cannot indeed ſay you are ſcrupulous about your affirmations, and yet I believe that even you will not affirm this; it being moſt evident, that the product of two real quantities is ſomething real; and that nothing real can be rejected either according to the ἀκρίβεια of geometry, or according to Sir *Iſaac*'s own principles; for the truth of which I appeal to all who know any thing of theſe matters. Further by *evaneſcant* muſt either be meant let them (the increments) vaniſh and become nothing, in the obvious ſenſe, or elſe let them become infinitely ſmall. But that this latter is not Sir *Iſaac*'s ſenſe is evident from his own words in the very ſame page, that is, in the laſt of his introduction to the Quadratures, where he expreſly ſaith *volui oſtendere quod in methodo fluxionum non opus ſit figuras in finite parvas in geometriam introducere.* Upon the whole, you ſeem to have conſidered this affair ſo very ſuperficially, as greatly to confirm me in the opinion, you are ſo angry with, to wit, that Sir *Iſaac*'s followers are much more eager in applying his method, than accurate in examining his principles. You raiſe a duſt about evaneſcent augments which may perhaps amuſe and amaze your reader, but I am much miſtaken if it ever inſtructs or enlightens him. For, to come to the point, thoſe evaneſcent augments either are real quantities, or they are not. If you ſay they are; I deſire to know, how you get rid of the rejectaneous quantity? If you ſay they are not; you indeed get rid of thoſe quantities in the compoſition whereof they are coefficients; but then you are of the ſame opinion with me, "which opinion you are pleaſed to call "(*P.* 58) a moſt palpable, inexcuſable, and unpardonable blunder, although "it be a truth moſt palpably evident."

XXXIV.

XXXIV. Nothing I ſay can be plainer to any impartial reader, than that by the evaneſcence of augments, in the above cited paſſage, Sir *Iſaac* means their being actually reduced to nothing. But to put it out of all doubt, that this is the truth, and to convince even you, who ſhew ſo little diſpoſition to be convinced, I deſire you to look into his *Analyſis per æquationes infinitas* (*P.* 20) where, in his preparation for demonſtrating the firſt rule for the ſquaring of ſimple curves, you will find that on a parallel occaſion, ſpeaking of an augment which is ſuppoſed to vaniſh, he interprets the word *evaneſcere* by *eſſe nihil.* Nothing can be plainer than this, which at once deſtroys your defence. And yet, plain as it is, I deſpair of making you acknowledge it; though I am ſure you feel it, and the reader if he uſeth his eyes muſt ſee it. The words *evaneſcere ſive eſſe nihil* do (to uſe your own expreſſion) ſtare us in the face. Lo! "This is what you call (*P.* 56) ſo great, ſo unaccountable, ſo horrid, ſo "truly *Bæotian* a blunder" that, according to you, it was not poſſible Sir *Iſaac Newton* could be guilty of it. For the future, I adviſe you to be more ſparing of hard words: ſince, as you incautiouſly deal them about, they may chance to light on your friends as well as your adverſaries. As for my part, I ſhall not retaliate. It is ſufficient to ſay you are miſtaken. But I can eaſily pardon your miſtakes. Though, indeed, you tell me on this very occaſion, that I muſt expect no quarter from Sir *Iſaac*'s followers. And I tell you that I neither expect nor deſire any. My aim is truth. My reaſons I have given. Confute them, if you can. But think not to overbear me either with authorities or harſh words. The latter will recoil upon yourſelves: the former in a matter of ſcience are of no weight with indifferent readers; and as for bigots, I am not concerned about what they ſay or think.

XXXV. In the next place you proceed to declaim upon the following paſſage taken from the ſeventeenth ſection of the Analyſt. "Conſidering "the various arts and devices uſed by the great author of the fluxionary "method:

" method: in how many lights he placeth his fluxions: and in what dif-
" ferent ways he attempts to demonſtrate the ſame point: one would be
" inclined to think, he was himſelf ſuſpicious of the juſtneſs of his own
" demonſtrations." This paſſage you complain of as very hard uſage of Sir *Iſaac Newton.* You declaim copiouſly, and endeavour to ſhew that placing the ſame point in various lights is of great uſe to explain it; which you illuſtrate with much rhetoric. But the fault of that paſſage is not the hard uſage it contains: but on the contrary, that it is too modeſt, and not ſo full and expreſſive of my ſenſe, as perhaps it ſhould have been. Would you like it better if I ſhould ſay, the various *inconſiſtent* accounts, which this great author gives of his momentums and his fluxions, may convince every intelligent reader that he had no clear and ſteady notions of them, without which which there can be no demonſtration? I own frankly that I ſee no clearneſs or conſiſtence in them. You tell me indeed, in *Miltonic* verſe that the fault is in my own eyes,

So thick a drop ſerene has quench'd their orbs
Or dim ſuffuſion veil'd.

at the ſame time you acknowledge yourſelf obliged for thoſe various lights, which have enabled you to underſtand his doctrine. But as for me who do not underſtand it, you inſult me ſaying: " For God's ſake
" what is it you are offended at, who do not ſtill underſtand him?" May not I anſwer, that I am offended for this very reaſon; becauſe I cannot underſtand him or make ſenſe of what he ſays? You ſay to me, that I am all in the dark. I acknowledge it, and intreat you who ſee ſo clearly to help me out.

XXXVI. You, Sir, with the bright eyes, be pleaſed to tell me, whether Sir *Iſaac*'s momentum be a finite quantity, or an infiniteſimal, or a mere limit? If you ſay a finite quantity: be pleaſed to reconcile this with what he ſaith in the ſcholium of the ſecond lemma of the firſt ſection of the

the firſt book of his principles: *Cave intelligas quantitates magnitudine determinatas, ſed cogita ſemper diminuendas ſine limite.* If you ſay, an infiniteſimal: reconcile this with what is ſaid in his introduction to the Quadratures: *Volui oſtendere quod in methodo fluxionum non opus ſit figuras infinite parvas in geometriam inducere.* If you ſhould ſay, it is a mere limit, be pleaſed to reconcile this with what we find in the firſt caſe of the ſecond lemma in the ſecond book of his principles: *Ubi de lateribus A et B deerant momentorum dimidia*, &c. where the moments are ſuppoſed to be divided. I ſhould be very glad, a perſon of ſuch a luminous intellect would be ſo good as to explain, whether by fluxions we are to underſtand the naſcent or evaneſcent quantities themſelves, or their motions, or their velocities, or ſimply their proportions: and having interpreted them in what ſenſe you will, that you would then condeſcend to explain the doctrine of ſecond, third, and fourth fluxions, and ſhew it to be conſiſtent with common ſenſe if you can. You ſeem to be very ſanguine when you expreſs yourſelf in the following terms. "I do aſſure "you, Sir, from my own experience, and that of many others whom I "could name, that the doctrine may be clearly conceived and diſtinctly "comprehended." (*P.* 31). And it may be uncivil not to believe what you ſo ſolemnly affirm, from your own experience. But I muſt needs own, I ſhould be better ſatisfied of this, if, inſtead of entertaining us with your rhetoric, you would vouchſafe to reconcile thoſe difficulties, and explain thoſe obſcure points abovementioned. If either you, or any one of thoſe many whom you could name, will but explain to others what you ſo clearly conceive yourſelves, I give you my word that ſeveral will be obliged to you who, I may venture to ſay, underſtand thoſe matters no more than myſelf. But, if I am not much miſtaken, you and your friends will modeſtly decline this taſk.

XXXVII. I have long ago done what you ſo often exhort me to do, diligently read and conſidered the ſeveral accounts of this doctrine given

by the great author in different parts of his writings: and upon the whole I could never make it out to be conſiſtent and intelligible. I was even led to ſay, " that one would be inclined to think, he was himſelf ſuſpi-
" cious of the juſtneſs of his own demonſtrations: and that he was not
" enough pleaſed with any one notion ſteadily to adhere to it." After which I added, " thus much is plain that he owned himſelf ſatisfied con-
" cerning certain points, which nevertheleſs he could not undertake to
" demonſtrate to others." See the ſeventeenth ſection of the Analyſt. It is one thing when a doctrine is placed in various lights: and another, when the principles and notions are ſhifted. When new devices are introduced and ſubſtituted for others, a doctrine inſtead of being illuſtrated may be explained away. Whether there be not ſomething of this in the preſent caſe I appeal to the writings of the great author. His *methodus rationum primarum et ultimarum*, his ſecond lemma in the ſecond book of his principles, his introduction and treatiſe of the quadrature of curves. In all which it appears to me, there is not one uniform doctrine explained and carried throughout the whole, but rather ſundry inconſiſtent accounts of this new method, which ſtill grows more dark and confuſed the more it is handled: I could not help thinking, the greateſt genius might lye under the influence of falſe principles; and where the object and notions were exceeding obſcure, he might poſſibly diſtruſt even his own demonſtrations. " At leaſt thus much ſeemed plain that Sir *Iſaac* had ſometime
" owned himſelf ſatisfied, where he could not demonſtrate to others.
" In proof whereof I mentioned his letter to Mr. *Collins*; hereupon you
" tell me: there is a great deal of difference between ſaying, I cannot
" undertake to prove a thing, and I will not undertake it." But in anſwer to this, I deſire you will be pleaſed to conſider, that I was not making a preciſe extract out of that letter, in which the very words of Sir *Iſaac* ſhould alone be inſerted. But I made my own remark and inference, from what I remembred to have read in that letter; where, ſpeaking of a certain mathematical matter, Sir *Iſaac* expreſſeth himſelf, in the following

following terms. " It is plain to me by the fountain I draw it from, " though I will not undertake to prove it to others." Now whether my inference may not be fairly drawn from thoſe words of Sir *Iſaac Newton*; and whether the difference as to the ſenſe be ſo great between *will* and *can* in that particular caſe, I leave to be determined by the reader.

XXXVIII. In the next paragraph you talk big but prove nothing. You ſpeak of driving out of intrenchments, of ſallying and attacking and carrying by aſſault; of ſlight and untenable works, of a new-raiſed and undiſciplined militia, and of veteran regular troops. Need the reader be a mathematician to ſee the vanity of this paragraph? After this you employ (*P.* 65) your uſual colouring, and repreſent the great author of the method of fluxions " as a good old gentleman faſt aſleep, and ſnoring " in his eaſy chair; while dame Fortune is bringing him her apron full " of beautiful theorems and problems, which he never knows or thinks " of." This you would have paſs for a conſequence of my notions. But I appeal to all thoſe who are ever ſo little knowing in ſuch matters, whether there are not divers fountains of experiment, induction, and analogy, whence a man may derive and ſatisfy himſelf concerning the truth of many points in mathematics and mechanical philoſophy, although the proofs thereof afforded by the modern analyſis ſhould not amount to demonſtration? I further appeal to the conſcience of all the moſt profound mathematicians, whether they can, with perfect acquieſcence of mind free from all ſcruple, apply any propoſition merely upon the ſtrength of a demonſtration involving ſecond or third fluxions, without the aid of any ſuch experiment or analogy or collateral proof whatſoever? Laſtly, I appeal to the reader's own heart, whether he cannot clearly conceive a medium between being faſt aſleep and demonſtrating? But you will have it, that I repreſent Sir *Iſaac*'s concluſions as coming out right, becauſe one error is compenſated by another contrary and equal error, which perhaps he never knew himſelf nor thought of: that by a twofold

miſtake he arrives though not at ſcience yet at truth: that he proceeds blindfold, *&c.* All which is untruly ſaid by you, who have miſapplied to Sir *Iſaac* what was intended for the Marquis de l'*Hoſpital* and his followers, for no other end (as I can ſee) but that you may have an opportunity, to draw that ingenious portraiture of Sir *Iſaac Newton* and dame Fortune, as will be manifeſt to whoever reads the Analyſt.

XXXIX. You tell me (*P.* 70), if I think fit to perſiſt in aſſerting, "that this affair of a double error is entirely a new diſcovery of my own, "which Sir *Iſaac* and his followers never knew nor thought of, that you "have unqueſtionable evidence to convince me of the contrary, and that "all his followers are already appriſed, that this very objection of mine "was long ſince foreſeen, and clearly and fully removed by Sir *Iſaac* "*Newton* in the firſt ſection of the firſt book of his *Principia*." All which I do as ſtrongly deny as you affirm. And I do aver, that this is an unqueſtionable proof of the matchleſs contempt which you, *Philalethes*, have for truth. And I do here publicly call upon you, to produce that evidence which you pretend to have, and to make good that fact which you ſo confidently affirm. And, at the ſame time, I do aſſure the reader that you never will, nor can.

XL. If you defend Sir *Iſaac*'s notions as delivered in his *Principia*, it muſt be on the rigorous foot of rejecting nothing, neither admitting nor caſting away infinitely ſmall quantities. If you defend the Marquis, whom you alſo ſtyle your maſter, it muſt be on the foot of admitting that there are infiniteſimals, that they may be rejected, that they are nevertheleſs real quantities, and themſelves infinitely ſubdiviſible. But you ſeem to have grown giddy with paſſion, and in the heat of controverſy to have miſtaken and forgot your part. I beſeech you, Sir, to conſider, that the Marquis (whom alone, and not Sir *Iſaac* this double error in finding the ſubtangent doth concern) rejects indeed infiniteſimals, but not

not on the foot that you do, to wit, their being inconſiderable in practical geometry or mixed mathematics. But he rejects them in the accuracy of ſpeculative knowledge: in which reſpect there may be great logical errors, although there ſhould be no ſenſible miſtake in practice: which, it ſeems, is what you cannot comprehend. He rejects them likewiſe in vertue of a poſtulatum, which I venture to call rejecting them without ceremony. And though he inferreth a concluſion accurately true, yet he doth it, contrary to the rules of logic, from inaccurate and falſe premiſes. And how this comes about, I have at large explained in the Analyſt, and ſhewed in that particular caſe of tangents, that the rejectaneous quantity might have been a finite quantity of any given magnitude, and yet the concluſion have come out exactly the ſame way; and conſequently, that the truth of this method doth not depend on the reaſon aſſigned by the Marquis, to wit, the *poſtulatum* for throwing away infiniteſimals, and therefore that he and his followers acted blindfold, as not knowing the true reaſon for the concluſions coming out accurately right, which I ſhew to have been the effect of a double error.

XLI. This is the truth of the matter, which you ſhamefully miſrepreſent and declaim upon, to no ſort of purpoſe but to amuſe and miſlead your reader. For which conduct of yours throughout your remarks, you will pardon me if I cannot otherwiſe account, than from a ſecret hope that the reader of your defence would never read the Analyſt. If he doth, he cannot but ſee what an admirable method you take to defend your cauſe: how inſtead of juſtifying the reaſoning, the logic or the theory of the caſe ſpecified, which is the real point, you diſcourſe of ſenſible and practical errors: and how all this is a manifeſt impoſition upon the reader. He muſt needs ſee that I have expreſsly ſaid, "I have no "controverſy except only about your logic and method: that I conſider "how you demonſtrate; what objects you are converſant about; and "whether you conceive them clearly? That I have often expreſſed my-

"ſelf

" ſelf to the ſame effect deſiring the reader to remember, that I am only " concerned about the way of coming at your theorems, whether it be " legitimate or illegitimate, clear or obſcure, ſcientific or tentative: that " I have on this very occaſion, to prevent all poſſibility of miſtake, re- " peated and inſiſted that I conſider the geometrical analyſt as a logician, " *i. e.* ſo far forth as he reaſons and argues; and his mathematical con- " cluſions not in themſelves but in their premiſes; not as true or falſe, " uſeful or inſignificant, but as derived from ſuch principles, and by ſuch " inferences." * You affirm (and indeed what can you not affirm?) that the difference between the true ſubtangent and that found without any compenſation is abſolutely nothing at all. I profeſs myſelf of a contrary opinion. My reaſon is becauſe nothing cannot be divided into parts. But this difference is capable of being divided into any, or into more than any given number of parts; for the truth of which conſult the Marquis de l'*Hoſpital*. And, be the error in fact or in practice ever ſo ſmall, it will not thence follow that the error in reaſoning, which is what I am alone concerned about, is one whit the leſs, it being evident that a man may reaſon moſt abſurdly about the minuteſt things.

XLII. Pray anſwer me fairly, once for all, whether it be your opinion that whatſoever is little and inconſiderable enough to be rejected without inconvenience in practice, the ſame may in like manner be ſafely rejected and overlooked in theory and demonſtration. If you ſay *no*, it will then follow, that all you have been ſaying here and elſewhere, about yards and inches and decimal fractions, ſetting forth and inſiſting on the extreme ſmallneſs of the rejectaneous quantity, is quite foreign to the argument, and only a piece of ſkill to impoſe upon your reader. If you ſay *yes*, it follows that you then give up at once all the orders of fluxions and infiniteſimal differences; and ſo moſt imprudently turn all your ſallies and attacks and veterans to your own overthrow. If the reader is

* *Analyſt*, Sect. XX.

of

of my mind, he will deſpair of ever ſeeing you get clear of this dilemma. The points in controverſy have been ſo often and ſo diſtinctly noted in the Analyſt, that I very much wonder how you could miſtake if you had no mind to miſtake. It is very plain, if you are in earneſt, that you neither underſtand me nor your maſters. And what ſhall we think of other ordinary analyſts, when it ſhall be found that even you, who, like a champion ſtep forth to defend their principles, have not conſidered them.

XLIII. The impartial reader is intreated to remark throughout your whole performance how confident you are in aſſerting and withal how modeſt in proving or explaining: how frequent it is with you to employ figures and tropes inſtead of reaſons: how many difficulties propoſed in the Analyſt are diſcreetly overlooked by you, and what ſtrange work you make with the reſt: how groſsly you miſtake and miſrepreſent, and how little you practiſe the advice which you ſo liberally beſtow. Believe me, ſir, I had long and maturely conſidered the principles of the modern analyſis, before I ventured to publiſh my thoughts thereupon in the Analyſt. And ſince the publication thereof, I have myſelf freely converſed with mathematicians of all ranks, and ſome of the ableſt profeſſors, as well as made it my buſineſs to be informed of the opinions of others, being very deſirous to hear what could be ſaid towards clearing my difficulties or anſwering my objections. But though you are not afraid or aſhamed, to repreſent the analyſts as very clear and uniform in their conception of theſe matters, yet I do ſolemnly affirm (and ſeveral of themſelves know it to be true) that I found no harmony or agreement among them, but the reverſe thereof, the greateſt diſſonance and even contrariety of opinions, employed to explain what after all ſeemed inexplicable.

XLIV.

XLIV. Some fly to proportions between nothings. Some reject quantities becauſe infiniteſimal. Others allow only finite quantities, and reject them becauſe inconſiderable. Others place the method of fluxions on a foot with that of *exhauſtions*, and admit nothing new therein. Some maintain the clear conception of fluxions. Others hold they can demonſtrate about things incomprehenſible. Some would prove the algoriſm of fluxions by *reductio ad abſurdum*; others *a priori*. Some hold the evaneſcent increments to be real quantities, ſome to be nothings, ſome to be limits. As many men, ſo many minds: each differing one from another, and all from Sir *Iſaac Newton*. Some plead inaccurate expreſſions in the great author, whereby they would draw him to ſpeak their ſenſe, not conſidering that if he meant as they do, he could not want words to expreſs his meaning. Others are magiſterial and poſitive, ſay they are ſatisfied, and that is all, not conſidering that we, who deny Sir *Iſaac Newton*'s authority, ſhall not ſubmit to that of his diſciples. Some inſiſt, that the concluſions are true, and therefore the principles, not conſidering what hath been largely ſaid in the Analyſt * on that head. Laſtly ſeveral (and thoſe none of the meaneſt), frankly owned the objections to be unanſwerable. All which I mention by way of antidote to your falſe colours: and that the unprejudiced inquirer after truth may ſee, it is not without foundation, that I call on the celebrated mathematicians of the preſent age to clear up theſe obſcure analytics, and concur in giving to the public ſome conſiſtent and intelligible account of the principles of their great maſter: which if they do not, I believe the world will take it for granted that they cannot.

XLV. Having gone through your defence of the *Britiſh* mathematicians, I find in the next place, that you attack me on a point of metaphyſics, with what ſucceſs the reader will determine. I had upon another

* Sect. XIX, XX, &c.

occaſion

occaſion many years ago wrote againſt abſtract general ideas *. In oppoſition to which, you declare yourſelf to adhere to the vulgar opinion, that neither geometry nor any other general ſcience can ſubſiſt without general ideas (*P.* 74). This implies that I hold there are no general ideas. But I hold the direct contrary, that there are indeed general ideas, but not formed by abſtraction in the manner ſet forth by Mr. *Locke*. To me it is plain, there is no conſiſtent idea, the likeneſs whereof may not really exiſt: whatſoever therefore is ſaid to be ſomewhat which cannot exiſt, the idea thereof muſt be inconſiſtent. Mr. *Locke* acknowledgeth it doth require pains and ſkill to form his general idea of a triangle. He further expreſsly ſaith, it muſt be neither oblique nor rectangular, neither equilateral, equicrural, nor ſcalenum; but all and none of theſe at once. He alſo ſaith, it is an idea wherein ſome parts of ſeveral different and incuſiſtent ideas are put together †. All this looks very like a contradiction. But to put the matter paſt diſpute, it muſt be noted, that he affirms it to be ſomewhat imperfect that cannot exiſt; conſequently the idea thereof is impoſſible or inconſiſtent.

XLVI. I deſire to know, whether it is not poſſible for any thing to exiſt, which doth not include a contradiction: and if it is, whether we may not infer, that what cannot poſſibly exiſt, the ſame doth include a contradiction: I further deſire to know, whether the reader can frame a diſtinct idea of any thing that includes a contradiction? For my part, I cannot, nor conſequently of the abovementioned triangle; though you (who it ſeems know better than myſelf what I can do) are pleaſed to aſſure me of the contrary. Again, I aſk whether that, which it is above the power of man to form a complete idea of, may not be called incomprehenſible? And whether the reader can frame a complete idea of

* Introduction to the Treatiſe concerning the Principles of Human Knowledge.

† Eſſay on Human Underſtanding, b. iv. c. vii. §. ix.

this imperfect impoſſible triangle? And if not, whether it doth not follow that it is incomprehenſible? It ſhould ſeem, that a diſtinct aggregate of a few conſiſtent parts was nothing ſo difficult to conceive or impoſſible to exiſt; and that, therefore, your comment muſt be wide of the author's meaning. You give me to underſtand (*P.* 82) that this account of a general triangle was a trap which Mr. *Locke* ſet to catch fools. Who is caught therein let the reader judge.

XLVII. It is Mr. *Locke*'s opinion, that every general name ſtands for a general abſtract idea, which preſcinds from the ſpecies or individuals comprehended under it. Thus, for example, according to him, the general name *colour* ſtands for an idea, which is neither blue, red, green, nor any other particular colour, but ſomewhat diſtinct and abſtracted from them all. To me it ſeems, the word *colour* is only a more general name applicable to all and each of the particular colours; while the other ſpecific names, as blue, red, green, and the like, are each reſtrained to a more limited ſignification. The ſame may be ſaid of the word triangle. Let the reader judge whether this be not the caſe; and whether he can diſtinctly frame ſuch an idea of colour as ſhall preſcind from all the ſpecies thereof, or of a triangle which ſhall anſwer Mr. *Locke*'s account, preſcinding and abſtracting from all the particular ſorts of triangles, in the manner aforeſaid.

XLVIII. I intreat my reader to think. For if he doth not, he may be under ſome influence from your confident and poſitive way of talking. But any one who thinks may, if I miſtake not, plainly perceive that you are deluded, as it often happens, by miſtaking the terms for ideas. Nothing is eaſier, than to define in terms or words that which is incomprehenſible in idea, foraſmuch as any words can be either ſeparated or joined as you pleaſe, but ideas always cannot. It is as eaſy to ſay a round ſquare as an oblong ſquare, though the former be inconceivable. If the reader

reader will but take a little care to diſtinguiſh between the definition and the idea, between words or expreſſions and the conceptions of the mind, he will judge of the truth of what I now advance, and clearly perceive how far you are miſtaken, in attempting to illuſtrate Mr. *Locke*'s doctrine, and where your miſtake lies. Or, if the reader is minded to make a ſhort work, he needs only at once to try, whether laying aſide the words he can frame in his mind the idea of an impoſſible triangle; upon which trial the iſſue of this diſpute may be fairly put. This doctrine of abſtract general ideas ſeemed to me a capital error, productive of numberleſs difficulties and diſputes, that runs not only throughout Mr. *Locke*'s book but through moſt parts of learning. Conſequently, my animadverſions thereupon were not an effect of being inclined to carp or cavil at a ſingle paſſage, as you would wrongfully inſinuate, but proceeded from a love of truth, and a deſire to baniſh, ſo far as in me lay, falſe principles and wrong ways of thinking, without reſpect of perſons. And indeed, though you and other party-men are violently attached to your reſpective maſters, yet I, who profeſs myſelf only attached to truth, ſee no reaſon why I may not as freely animadvert on Mr. *Locke* or Sir *Iſaac Newton*, as they would on *Ariſtotle* or *Deſcartes*. Certainly the more extenſive the influence of any error, and the greater the authority which ſupports it, the more it deſerves to be conſidered and detected by ſincere inquirers after knowledge.

XLIX. In the cloſe of your performance, you let me underſtand, that your zeal for truth and the reputation of your maſters hath occaſioned your reprehending me with the utmoſt freedom. And it muſt be owned you have ſhewn a ſingular talent therein. But I am comforted under the ſeverity of your reprehenſions, when I conſider the weakneſs of your arguments, which, were they as ſtrong as your reproofs, could leave no doubt in the mind of the reader concerning the matters in diſpute between us. As it is, I leave him to reflect and examine by your light,

how clearly he is enabled to conceive a fluxion, or the fluxion of a fluxion, a part infinitely ſmall ſubdivided into an infinity of parts, a naſcent or evaneſcent increment, that which is neither ſomething nor nothing, a triangle formed in a point, velocity without motion, and the reſt of thoſe *arcana* of the modern analyſis. To conclude, I had ſome thoughts of adviſing you how to conduct yourſelf for the future, in return for the advice you have ſo freely imparted to me: but, as you think it becomes me rather to inform myſelf than inſtruct others, I ſhall, for my further information, take leave to propoſe a few Queries to thoſe learned gentlemen of *Cambridge*, whom you aſſociate with yourſelf, and repreſent as being equally ſurpriſed at the tendency of my Analyſt.

L. I deſire to know, whether thoſe who can neither demonſtrate nor conceive the principles of the modern analyſis, and yet give into it, may not be juſtly ſaid to have faith, and be ſtyled believers of myſteries? Whether it is impoſſible to find among the phyſicians, mechanical philoſophers, mathematicians, and philomathematicians of the preſent age, ſome ſuch believers, who yet deride chriſtians for their belief of myſteries? Whether with ſuch men it is not a fair, reaſonable, and legitimate method to uſe the *argumentum ad hominem?* And being ſo, whether it ought to ſurpriſe either chriſtians or ſcholars? Whether in an age wherein ſo many pretenders to ſcience attack the chriſtian religion, we may not be allowed to make repriſals, in order to ſhew that the irreligion of thoſe men is not to be preſumed an effect of deep and juſt thinking? Whether an attempt to detect falſe reaſonings, and remedy defects in mathematics, ought to be ill received by mathematicians? Whether the introducing more eaſy methods and more intelligible principles in any ſcience ſhould be diſcountenanced? Whether there may not be fair objections as well as cavils? And whether to inquire diligently into the meaning of terms and the proof of propoſitions, not excepting againſt any thing without aſſigning a reaſon, nor affecting to miſtake the ſignification of words,

words, or ſtick at an expreſſion where the ſenſe was clear, but conſidering the ſubject in all lights, ſincerely endeavouring to find out any ſenſe or meaning whatſoever, candidly ſetting forth what ſeems obſcure and what fallacious, and calling upon thoſe, who profeſs the knowledge of ſuch matters, to explain them, whether I ſay ſuch a proceeding can be juſtly called cavilling? Whether there be an *ipſe dixit* erected? And if ſo, when, where, by whom, and upon what authority? Whether even where authority was to take place, one might not hope the mathematics, at leaſt, would be excepted? Whether the chief end, in making mathematics ſo conſiderable a part of academical education, be not to form in the minds of young ſtudents habits of juſt and exact reaſoning? And whether the ſtudy of abſtruſe and ſubtil matters can conduce to this end, unleſs they are well underſtood, examined, and ſifted to the bottom? Whether, therefore, the bringing geometrical demonſtrations to the ſevereſt teſt of reaſon ſhould be reckoned a diſcouragement to the ſtudies of any learned ſociety? Whether to ſeparate the clear parts of things from the obſcure, to diſtinguiſh the real principles, whereon truths reſt, and whence they are derived, and to proportion the juſt meaſures of aſſent according to the various degrees of evidence, be an uſeleſs or unworthy undertaking? Whether the making more of an argument than it will bear, and placing it in an undue rank of evidence, be not the likely way to diſparage it? Whether it may not be of ſome uſe, to provoke and ſtir up the learned profeſſors to explain a part of mathematical learning, which is acknowledged to be moſt profound, difficult, and obſcure, and at the ſame time ſet forth by *Philalethes* and many others, as the greateſt inſtance that has ever been given of the extent of human abilities? Whether for the ſake of a great man's diſcoveries, we muſt adopt his errors? Laſtly, whether in an age wherein all other principles are canvaſſed with the utmoſt freedom, the principles of fluxions are to be alone excepted?

AN

APPENDIX

CONCERNING

Mr. WALTON's Vindication of Sir ISAAC NEWTON's Principles of Fluxions.

I. I HAD no ſooner conſidered the performance of *Philalethes*, but Mr. *Walton*'s Vindication of Fluxions was put into my hands. As this *Dublin* profeſſor gleans after the *Cantabrigian*, only endeavouring to tranſlate a few paſſages from Sir *Iſaac Newton*'s *Principia*, and enlarge on a hint or two of *Philalethes*, he deſerves no particular notice. It may ſuffice to adverti ſe the reader, that the foregoing defence, contains a full and explicit anſwer to Mr. *Walton*, as he will find, if he thinks it worth his pains to read what this gentleman hath written, and compare it therewith. Particularly with Sect. 18, 20, 30, 32, 33, 34, 35, 36, 43. It is not, I am ſure, worth mine to repeat the ſame things, or confute the ſame notions twice over, in mere regard to a writer who hath copied even the manners of *Philalethes*, and whom in anſwering the other I have, if I am not much miſtaken, ſufficiently anſwered.

II. Mr.

II. Mr. *Walton* touches on the ſame points that the other had touched upon before him. He purſues a hint which the other had given, * about Sir *Iſaac*'s firſt ſection concerning the *rationes primæ & ultimæ*. He diſcreetly avoids, like the other, to ſay one ſyllable of ſecond, third, or fourth fluxions, and of divers other points mentioned in the Analyſt, about all which I obſerve in him a moſt prudent and profound ſilence. And yet he very modeſtly gives his reader to underſtand, that he is able to clear up all difficulties and objections, that have ever been made (*P.* 5). Mr. *Walton* in the beginning, like *Philalethes*, from a particular caſe makes a general inference, ſuppoſing that infidelity to be imputed to mathematicians in general, which I ſuppoſe only in the perſon to whom the Analyſt was addreſſed, and certain other perſons of the ſame mind with him. Whether this extraordinary way of reaſoning be the cauſe or effect of his paſſion, I know not: but before I had got to the end of his Vindication, I ceaſed to be ſurpriſed at his logic and his temper in the beginning. The double error, which in the Analyſt was plainly meant to belong to others, he with *Philalethes* (whoſe very overſights he adopts) ſuppoſeth to have been aſcribed to Sir *Iſaac Newton* (*P.* 36). And this writer alſo, as well as the *Cantabrigian*, muſt needs take upon him to explain the motive of my writing againſt fluxions: which he gives out, with great aſſurance, to have been, becauſe Sir *Iſaac Newton* had preſumed to interpoſe in prophecies and revelations, and to decide in religious affairs (*P.* 4), which is ſo far from being true, that, on the contrary, I have a high value for thoſe learned remains of that great man, whoſe original and free genius is an eternal reproach to that tribe of followers, who are always imitating, but never reſemble him. This ſpecimen of Mr. *Walton*'s truth will be a warning to the reader to uſe his own eyes, and in obſcure points never to truſt the gentleman's candour, who dares to miſrepreſent the plaineſt.

* *Philalethes*, p. 32.

III. I was thinking to have ſaid no more concerning this author's performance, but leſt he ſhould imagine himſelf too much neglected, I intreat the reader to have the patience to peruſe it; and if he finds any one point of the doctrine of fluxions cleared up, or any one objection in the Analyſt anſwered, or ſo much as fairly ſtated, let him then make his compliments to the author. But, if he can no more make ſenſe of what this gentleman has written than I can, he will need no anſwer to it. Nothing is eaſier, than for a man to tranſlate or copy, or compoſe a plauſible diſcourſe of ſome pages in technical terms, whereby he ſhall make a ſhew of ſaying ſomewhat, although neither the reader nor himſelf underſtand one tittle of it. Whether this be the caſe of Mr. *Walton*, and whether he underſtands either Sir *Iſaac Newton*, or me, or himſelf, (whatever I may think) I ſhall not take upon me to ſay. But one thing I know, that many an unmeaning ſpeech paſſeth for ſignificant by the mere aſſurance of the ſpeaker, till he cometh to be catechiſed upon it; and then the truth ſheweth itſelf. This vindicator, indeed, by his diſſembling nine parts in ten of the difficulties propoſed in the Analyſt, ſheweth no inclination to be catechiſed by me. But his ſcholars have a right to be informed. I therefore, recommend it to them, not to be impoſed on by hard words and magiſterial aſſertions, but carefully to pry into his ſenſe, and ſift his meaning; and particularly to inſiſt on a diſtinct anſwer to the following queſtions.

IV. Let them aſk him, whether he can conceive velocity without motion, or motion without extenſion, or extenſion without magnitude? If he anſwers that he can, let him teach them to do the ſame. If he cannot, let him be aſked, how he reconciles the idea of a fluxion which he gives (*P.* 13), with common ſenſe? Again, let him be aſked, whether nothing be not the product of nothing multiplied by ſomething? And if ſo, when the difference between the gnomen and the ſum of the rectangles

gles * vaniſheth, whether the rectangles themſelves do not alſo vaniſh? *i. e.* when $a\,b$ is nothing, whether $A\,b + B\,a$ be not alſo nothing? *i. e.* whether the momentum of AB be not nothing? Let him then be aſked, what his momentums are good for, when they are thus brought to nothing? Again, I wiſh he were aſked to explain the difference, between a magnitude infinitely ſmall and a magnitude infinitely diminiſhed. If he ſaith there is no difference: then let him be further aſked, how he dares to explain the method of fluxions, by the *ratio* of magnitudes infinitely diminiſhed (*P.* 9), when Sir *Iſaac Newton* hath expreſsly excluded all conſideration of quantities infinitely ſmall? † If this able vindicator ſhould ſay that quantities infinitely diminiſhed are nothing at all, and conſequently that, according to him, the firſt and laſt *ratio*'s are proportions between nothings, let him be deſired to make ſenſe of this, or explain what he means by *proportion between nothings*. If he ſhould ſay the ultimate proportions are the *ratio*'s of mere limits, then let him be aſked how the limits of lines can be proportioned or divided? After all, who knows but this gentleman, who hath already complained of me for an uncommon way of treating mathematics and mathematicians (*P.* 5), may (as well as the *Cantabrigian*) cry out, *Spain* and the *inquiſition*, when he finds himſelf thus cloſely purſued and beſet with interrogatories? That we may not, therefore, ſeem too hard on an innocent man, who probably meant nothing, but was betrayed by following another into difficulties and ſtraits that he was not aware of, I ſhall propoſe one ſingle expedient, by which his diſciples (whom it moſt concerns) may ſoon ſatisfy themſelves, whether this vindicator really underſtands what he takes upon him to vindicate. It is in ſhort, that they would aſk him to explain the ſecond, third, or fourth fluxions upon his principles. Be this the touchſtone of his vindication. If he can do it, I ſhall own myſelf

* See Vindication, p. 17.

† See his Introduction to the Quadratures.

much miſtaken: if he cannot, it will be evident that he was much miſtaken in himſelf, when he preſumed to defend fluxions without ſo much as knowing what they are. So having put the merits of the cauſe on this iſſue, I leave him to be tried by his ſcholars.

REASONS

FOR NOT REPLYING TO

Mr. WALTON's full ANSWER,

IN A

LETTER to P. T. P.

REASONS, &c.

I. THERE are ſome men that can neither give nor take an anſwer, but writing merely for the ſake of writing multiply words to no purpoſe. There are alſo certain careleſs writers, that in defiance of common ſenſe publiſh ſuch things as, though they are not aſhamed to utter, yet, other men may well be aſhamed to anſwer. Whether there be any thing in Mr. *Walton*'s method of vindicating fluxions, that might juſtify my taking no further notice of him on the abovementioned conſiderations, I leave you and every other reader to judge. But thoſe, ſir, are not the reaſons I ſhall aſſign for not replying to Mr. *Walton*'s full anſwer. The true reaſon is, that he ſeems at bottom a facetious man, who under the colour of an opponent writes on my ſide of the queſtion, and really believes no more than I do of Sir *Iſaac Newton*'s doctrine about fluxions, which he expoſes, contradicts, and confutes with great ſkill and humour, under the maſque of a grave vindication.

II. At firſt I conſidered him in another light, as one who had good reaſon for keeping to the beaten track, who had been uſed to dictate, who had terms of art at will, but was indeed, at ſmall trouble about putting them together, and perfectly eaſy about his reader's underſtanding them. It muſt be owned, in an age of ſo much ludicrous humour, it is not every one can at firſt ſight diſcern a writer's real deſign. But, be a man's aſſertions ever ſo ſtrong in favour of a doctrine, yet if his reaſonings are directly levelled againſt it, whatever queſtion there may be about the matter in diſpute, there can be none about the intention

of

of the writer. Should a perſon, ſo knowing and diſcreet as Mr. *Walton*, thwart and contradict Sir *Iſaac Newton* under pretence of defending his fluxions, and ſhould he at every turn ſay ſuch uncouth things of theſe ſame fluxions, and place them in ſuch odd lights, as muſt ſet all men in their wits againſt them, could I hope for a better ſecond in this cauſe? Or could there remain any doubt of his being a diſguiſed freethinker in mathematics, who defended fluxions juſt as a certain freethinker in religion did the rights of the chriſtian church.

III. Mr. *Walton* indeed after his free manner calls my Analyſt a libel.* But this ingenious gentleman well knows a bad vindication is the bittereſt libel. Had you a mind, ſir, to betray and ridicule any cauſe under the notion of vindicating it, would you not think it the right way to be very ſtrong and dogmatical in the affirmative, and very weak and puzzled in the argumentative parts of your performance? To utter contradictions and paradoxes without remorſe, and to be at no pains about reconciling or explaining them? And with great good humour, to be at perpetual variance with yourſelf and the author you pretend to vindicate? How ſucceſsfully Mr. *Walton* hath practiſed theſe arts, and how much to the honour of the great client he would ſeem to take under his protection, I ſhall particularly examine throughout every article of his full anſwer.

IV. Firſt then, ſaith Mr. *Walton*, "I am to be aſked, whether I can "conceive velocity without motion, or motion without extenſion, or "extenſion without magnitude?" To which he anſwereth in poſitive terms, that he can conceive velocity and motion in a point (*P.* 7). And to make out this, he undertakes to demonſtrate, "that if a thing be "moved by an agent operating continually with the ſame force, the ve-"locity will not be the ſame in any two different points of the deſcribed

* Vindication, p. 1.

"ſpace.

" ſpace. But that it muſt vary upon the leaſt change of ſpace." Now admitting thus much to be demonſtrated, yet I am ſtill at a loſs to perceive how Mr. *Walton*'s concluſion will follow, to wit, " that I am greatly " miſtaken in imagining there can be no motion, no velocity in a point of ſpace (*P.* 10)." Pray, ſir, conſider his reaſoning. The ſame velocity cannot be in two points of ſpace; therefore velocity can be in a point of ſpace. Would it not be juſt as good reaſoning to ſay, the ſame man cannot be in two nutſhells; therefore a man can be in a nutſhell? Again, velocity muſt vary upon the leaſt change of ſpace; therefore there may be velocity without ſpace. Make ſenſe of this if you can. What have theſe conſequences to do with their premiſes? Who but Mr. *Walton* could have inferred them? Or how could even he have inferred them, had it not been in jeſt.

V. Suppoſe the center of a falling body to deſcribe a line, divide the time of its fall into equal parts, for inſtance into minutes. The ſpaces deſcribed in thoſe equal parts of time will be unequal. That is, from whatſoever points of the deſcribed line you meaſure a minute's deſcent, you will ſtill find it a different ſpace. This is true. But how or why from this plain truth a man ſhould infer, that motion can be conceived in a point, is to me as obſcure as any the moſt obſcure myſteries that occur in this profound author. Let the reader make the beſt of it. For my part, I can as eaſily conceive Mr. *Walton* ſhould walk without ſtirring, as I can his idea of motion without ſpace. After all, the queſtion was not whether motion could be proved to exiſt in a point, but only whether it could be conceived in a point. For, as to the proof of things impoſſible, ſome men have a way of proving that may equally prove any thing. But I much queſtion whether any reader of common ſenſe will undertake to conceive what this pleaſant man at inference undertakes to prove.

VI. If

VI. If Mr. *Walton* really meant to defend the author of the fluxionary method, would he not have done it in a way conſiſtent with this illuſtrious author's own principles? Let us now ſee what may be Sir *Iſaac*'s notion about this matter. He diſtinguiſheth two ſorts of motion, abſolute and relative. The former he defineth to be a tranſlation from abſolute place to abſolute place, the latter from one relative place to another. * Mr. *Walton*'s is plainly neither of theſe ſorts of motion, but ſome third kind, which what it is, I am at a loſs to comprehend. But I can clearly comprehend that, if we admit motion without ſpace, then Sir *Iſaac Newton*'s account of it muſt be wrong: for place by which he defines motion is, according to him, a part of ſpace. And if ſo, then this notable defender hath cut out new work for himſelf to defend and explain. But about this, if I miſtake not, he will be very eaſy. For, as I ſaid before, he ſeems at bottom a back friend to that great man; which opinion you will ſee further confirmed in the ſequel.

VII. I ſhall no more aſk Mr. *Walton* to explain any thing. For I can honeſtly ſay, the more he explains, the more I am puzzled. But I will aſk his readers to explain, by what art a man may conceive motion without ſpace. And ſuppoſing this to be done, in the ſecond place to explain, how it conſiſts with Sir *Iſaac Newton*'s account of motion. Is it not evident, that Mr. *Walton* hath deſerted from his old maſter, and been at ſome pains to expoſe him, while he defends one part of his principles by overturning another? Let any reader tell me, what Mr. *Walton* means by motion, or if he can gueſs, what this third kind is, which is neither abſolute nor relative, which exiſts in a point, which may be conceived without ſpace. This learned profeſſor ſaith, "I have no clear concep-" tion of the principles of motion." (*P.* 24) And in another place (*P.* 7) he ſaith, "I might have conceived velocity in a point, if I had under-" ſtood and conſidered the nature of motion." I believe I am not alone

* See Schol. def viii. Philoſ. Nat. Princip. Math.

in

in not underſtanding his principles. For myſelf, I freely confeſs the caſe to be deſperate. I neither underſtand them, nor have any hopes of being ever able to underſtand them.

VIII. Being now ſatisfied, that Mr. *Walton*'s aim is not to clear up or defend Sir *Iſaac*'s principles, but rather to contradict and expoſe them, you will not, I ſuppoſe, think it ſtrange, if inſtead of putting queſtions to this intrepid anſwerer, who is never at a loſs, how often ſoever his readers may, I entreat you, or any other man of plain ſenſe, to read the following paſſage cited from the thirty-firſt ſection of the Analyſt, and then try to apply Mr. *Walton*'s anſwer to it: whereby you will clearly perceive what a vein of raillery that gentleman is maſter of. "Velocity "neceſſarily implies both time and ſpace, and cannot be conceived with-"out them. And if the velocities of naſcent and evaneſcent quantities, "*i. e.* abſtracted from time and ſpace, may not be comprehended, how "can we comprehend and demonſtrate their proportions? Or conſider "their *rationes primæ & ultimæ*. For to conſider the proportion or ratio "of things implieth that ſuch things have magnitude: that ſuch their "magnitudes may be meaſured, and their relations to each other known. "But, as there is no meaſure of velocity except time and ſpace, the pro-"portion of velocities being only compounded of the direct proportion "of the ſpaces and the reciprocal proportion of the times; doth it not "follow, that to talk of inveſtigating, obtaining, and conſidering the "proportions of velocities, excluſively of time and ſpace, is to talk unin-"telligibly?" Apply now, as I ſaid, Mr. *Walton*'s full anſwer, and you will ſoon find how fully you are enlightened about the nature of fluxions.

IX. In the following article of Mr. *Walton*'s full anſwer, he ſaith divers curious things, which, being derived from this ſame principle, that motion may be conceived in a point, are altogether as incomprehenſible as the origin from whence they flow. It is obvious and natural to ſup-

poſe $A\,b$ and $B\,a$ * to be rectangles produced from finite lines multiplied by increments. Mr. *Walton* indeed ſuppoſeth that when the increments vaniſh or become nothing, the velocities remain, which being multiplied by finite lines produce thoſe rectangles (*P.* 13). But admitting the velocities to remain, yet how can any one conceive a rectangular ſurface to be produced from a line multiplied by velocity, otherwiſe than by ſuppoſing ſuch line multiplied by a line or increment, which ſhall be exponent of or proportional to ſuch velocity? You may try to conceive it otherwiſe. I muſt own I cannot. Is not the increment of a rectangle itſelf a rectangle? muſt not then $A\,b$ and $B\,a$ be rectangles? And muſt not the coefficients or ſides of rectangles be lines? Conſequently are not b and a lines or (which is the ſame thing) increments of lines? Theſe increments may indeed be conſidered as proportional to and exponents of velocity. But excluſive of ſuch exponents to talk of rectangles under lines and velocities is, I conceive, to talk unintelligibly. And yet this is what Mr. *Walton* doth, when he maketh b and a in the rectangles $A\,b$ and $B\,a$ to denote mere velocities.

X. As to the queſtion, whether nothing be not the product of nothing multiplied by ſomething, Mr. *Walton* is pleaſed to anſwer in the affirmative. And nevertheleſs when $a\,b$ is nothing, that is, when a and b are nothing, he denies that $A\,b + B\,a$ is nothing. This is one of thoſe many inconſiſtencies which I leave the reader to reconcile. But, ſaith Mr. *Walton*, the ſides of the given rectangle ſtill remain, which two ſides according to him muſt form the increment of the flowing rectangle. But in this he directly contradicts Sir *Iſaac Newton*, who aſſerts that $A\,b + B\,a$ and not $A + B$ is the increment of the rectangle $A\,B$. And, indeed, how is it poſſible, a line ſhould be the increment of a ſurface? *Laterum incrementis totis* a *et* b *generatur rectanguli incrementum* $A\,b + B\,a$ are the words of Sir *Iſaac* †, which words ſeem utterly inconſiſtent with Mr.

* See Nat. Phil. Princip. Math. l. 2. lem. 2. † Ib.

Walton's

Walton's doctrine. But, no wonder that gentleman ſhould not agree with Sir *Iſaac*, ſince he cannot agree even with himſelf; but contradicts what he ſaith elſewhere as the reader may ſee, even before he gets to the end of that ſame ſection, wherein he hath told us that " the gnomen and the " ſum of the two rectangles are turned into thoſe two ſides by a retro- " verted motion (*P.* 11 and 12)." Which propoſition if you or any other perſon ſhall try to make ſenſe of, you may poſſibly be convinced, that this profound author is as much at variance with common ſenſe, as he is with himſelf and Sir *Iſaac Newton.*

XI. Mr. *Walton* in the ninth page of his Vindication, in order to explain the nature of fluxions, ſaith that " to obtain the laſt ratio of ſyn- " chronal increments, the magnitude of thoſe increments muſt be infi- " nitely diminiſhed." Notwithſtanding which, in the twenty-third page of his full anſwer, he chargeth me as greatly miſtaken, in ſuppoſing that he explained the doctrine of fluxions by the ratio of magnitudes infinitely diminiſhed. It is an eaſy matter, for any author to write ſo, as to betray his readers into miſtakes about his meaning. But then it is not eaſy to conceive, what right he hath to upbraid them with ſuch their miſtakes. If I have miſtaken his ſenſe, let any one judge if he did not fairly lead me into the miſtake. When a man puzzleth his reader, ſaith and unſaith, uſeth ambiguous terms and obſcure terms, and putteth them together in ſo perverſe a manner, that it is odds you can make out no ſenſe at all, or if any, a wrong ſenſe, pray who is in fault but the writer himſelf? Let any one conſider Mr. *Walton*'s own words, and then ſay whether I am not juſtified in making this remark.

XII. In the twentieth page of his full anſwer Mr. *Walton* tells us, that " fluxions are meaſured by the firſt or laſt proportions of iſochronal in- " crements generated or deſtroyed by motion." A little after he ſaith theſe ratios ſubſiſt when the iſochronal increments have no magnitude.

Now, I would fain know whether the iſochronal increments themſelves ſubſiſt when they have no magnitude? Whether by iſochronal increments we are not to underſtand increments generated in equal times? Whether there can be an increment where there is no increaſe, or increaſe where there is no magnitude? Whether if magnitudes are not generated in thoſe equal times, what elſe is generated therein, or what elſe is it that Mr. *Walton* calls iſochronal? I aſk the reader theſe queſtions. I dare not aſk Mr. *Walton*. For, as I hinted before, the ſubject grows ſtill more obſcure in proportion as this able writer attempts to illuſtrate it.

XIII. We are told (*P.* 22) " that the firſt or laſt ratio of the iſochro- " nal ſpaces hath a real exiſtence, foraſmuch as it is equal to the ratio of " the two motions of two points; which motions, ſubſiſting when the " iſochronal ſpaces are nothing; preſerve the exiſtence of the firſt or laſt " ratio of theſe ſpaces, or keep it from being a ratio of nothings." In order to aſſiſt your underſtanding, it muſt not be omitted that the ſaid two points are ſuppoſed to exiſt at the ſame time in one point, and to be moved different ways without ſtirring from that point. Mr. *Walton* hath the conſcience to call this riddle a full and clear anſwer: to make ſenſe of which you muſt ſuppoſe it one of his ironies. In the next and laſt article of his performance, you ſtill find him proceed in the ſame vein of raillery upon fluxions.

XIV. It will be allowed, that whoever ſeriouſly undertook to explain the ſecond, third, and fourth fluxions of Sir *Iſaac Newton*, would have done it in a way agreeable to that great man's own doctrine. What Sir *Iſaac*'s preciſe notion is I will not pretend to ſay. And yet I will venture to ſay, it is ſomething that cannot be explained by the three dimenſions of a cube. I frankly own, I do not underſtand Sir *Iſaac*'s doctrine ſo far as to frame a poſitive idea of his fluxions. I have, nevertheleſs, a negative

tive conception thereof, ſo far as to ſee that Mr. *Walton* is in jeſt, or (if in earneſt) that he underſtands it no more than I do.

XV. Sir *Iſaac* tells us that he conſiders indeterminate quantities as flowing, or in other words, as increaſing or decreaſing by a perpetual motion. Which quantities he denotes by the latter letters of the alphabet, and their fluxions or celerities of increaſing by the ſame letters pointed over head, and the fluxions of fluxions or ſecond fluxions, *i. e.* the mutations more or leſs ſwift of the firſt celerities by the ſame letters pointed with double points; and the mutations of thoſe mutations of the firſt mutations or fluxions or celerities of increaſing, which he calls fluxions of fluxions of fluxions or third fluxions, by three points; the fourth fluxions by four points; the fifth by five; and ſo on*. Sir *Iſaac*, you ſee, ſpeaks of quantity in general. And in the Analyſt the doctrine is exemplified and the caſe is put in lines. Now in lines, where there is only one dimenſion, how are we enabled to conceive ſecond, third or fourth fluxions by conceiving the generation of three dimenſions in a cube? Let any one but read what Sir *Iſaac Newton* or what I have ſaid, and then apply what Mr. *Walton* hath written about the three dimenſions of a cube, and ſee whether the difficulties are ſolved, or the doctrine made one whit the clearer by this explication.

XVI. That you may the better judge of the merit of this part of Mr. *Walton*'s performance, I ſhall beg leave to ſet down a paſſage or two from the Analyſt. "As it is impoſſible to conceive velocity without "time or ſpace, without either finite length or finite duration, it muſt "ſeem above the power of man to comprehend even the firſt fluxions. "And if the firſt are incomprehenſible, what ſhall we ſay of the ſecond "and third fluxions, *&c.* He who can conceive the beginning of a be-"ginning or the end of an end, ſomewhat before the firſt or after the

* See his Treatiſe de quadratura curvarum.

"laſt,

" laſt, may perhaps be ſharp-ſighted enough to conceive theſe things. " But moſt men, I believe, will find it impoſſible to underſtand them in " any ſenſe whatſoever. One would think that men could not ſpeak too " exactly on ſo nice a ſubject. And yet we may often obſerve, that the " exponents of fluxions or notes repreſenting fluxions are confounded " with the fluxions themſelves. Is not this the caſe, when juſt after the " fluxions of flowing quantities, were ſaid to be the celerities of their in- " creaſing and the ſecond fluxions to be the mutations of the firſt fluxions " or celerities, we are told that $\ddot{z}.\ \dot{z}.\ z.\ z.\ z.\ z.$ repreſents a ſeries of quan- " tities whereof each ſubſequent quantity is the fluxion of the preceding; " and each foregoing is a fluent quantity having the following one for its " fluxion. Divers ſeries of quantities and expreſſions geometrical and " algebraical may be eaſily conceived in lines, in ſurfaces, in ſpecies, to " be continued without end or limit. But it will not be found ſo eaſy to " conceive a ſeries, either of mere velocities or of mere naſcent incre- " ments, diſtinct therefrom and correſponding thereunto." * Compare what is here ſaid with Mr. *Walton*'s geneſis of a cube, and you will then clearly ſee how far this anſwerer is from explaining the nature of ſecond, third and fourth fluxions: and how juſtly I might repay that gentleman in kind, and tell him in his own language, that *all his ſkill is vain and impertinent*, (Vind. *p.* 36.)

XVII. But it doth not become me to find fault with this learned profeſſor, who at bottom militates on my ſide, and in this very ſection, makes it his buſineſs directly to overthrow Sir *Iſaac Newton*'s doctrine. For he ſaith in plain terms, that there can be no fourth fluxion of a cube (*P.* 25), that is, there can be no ſecond fluxion of a line, and *a fortiori*, no third, fourth, fifth, *&c.* Inſomuch, that with one ſingle daſh of his pen, Mr. *Walton* deſtroys, to the great relief of the learned world, an

* Analyſt, Sect. XLIV, XLV, XLVI.

indefinite

indefinite rank of fluxions of different orders that might have reached from pole to pole. I had diſtinctly pointed out the difficulties in ſeveral parts both of my Analyſt and Defence, and I leave you to judge whether he explains or even attempts to explain one of them. Inſtead thereof he tells us of the trine dimenſion of a cube generated by motion: whence he takes occaſion, as hath been obſerved, to explode Sir *Iſaac*'s own doctrine, which is utterly inconſiſtent with Mr. *Walton*'s. And can you now doubt the real deſign of this egregious vindicator.

XVIII. Before ever Sir *Iſaac Newton* thought of his fluxions, every body knew there were three dimenſions in a cube, and that a ſolid might be generated by the motion of a ſurface, a ſurface by the motion of a line, and a line by the motion of a point. And this in effect is all we know from Mr. *Walton*'s explication. As for his dwelling ſo minutely on the geneſis of the ſolid parts of a cube, a thing ſo foreign from the purpoſe, the only rational account I can give of it is, that Mr. *Walton*, by puzzling the imagination of his vulgar readers, hoped the better to diſguiſe his betraying the doctrine of his great client, which to a diſcerning eye he manifeſtly gives up; and inſtead thereof humourouſly ſubſtitutes, what all the world knew before Sir *Iſaac* was born, to wit, the three dimenſions of a cube and the geneſis thereof by motion.

XIX. Upon the whole I appeal to you and every intelligent reader, whether this thing, which Mr. *Walton* is pleaſed ironically to call a full anſwer, doth not carry throughout a ſly inſinuation, that the profound ſcience of fluxions cannot be maintained but by the help of moſt unintelligible paradoxes and inconſiſtencies. So far, indeed, as affirmations go he ſheweth himſelf an able ſupport of Sir *Iſaac Newton*. But then in his reaſonings he drops that great man upon the moſt important points, to wit, his doctrine of motion and his doctrine of fluxions, not regarding how far the demonſtration of his famous *Principia* is intereſted therein.

To

To convince you ſtill more and more of the truth hereof, do but reflect a little on Mr. *Walton*'s conduct. Can you think it probable, that ſo learned and clear-headed a writer would have laid down ſuch a direct repugnancy to common ſenſe, as his idea of motion in a point, for the ground work of his explanation, had it been his real intention to explain? Or can you ſuppoſe, he would have been abſolutely ſilent, on ſo many points urged home, both in the Analyſt and Defence, which it concerned a vindicator of Sir *Iſaac* not to have overlooked? Can you imagine, that if he meant ſeriouſly to defend the doctrine of fluxions, he would have contented himſelf with barely aſſerting that "Sir *Iſaac Newton* in the introduction to his Quadrature of Curves, in the ſecond lemma of the ſecond book, and in the ſcholium to the firſt ſection of the firſt book of his principles of philoſophy, hath delivered his doctrine of fluxions in ſo clear and diſtinct a manner, without the leaſt inconſiſtency in terms or arguments, that one would have thought it impoſſible for any perſon not to have underſtood him (*P.* 30)."

XX. Is it poſſible, I ſay, that Mr. *Walton* could in earneſt hope we ſhould take his bare word, as ſo much more credible than Sir *Iſaac*'s, and not rather have endeavoured to anſwer the queſtions and reconcile the difficulties ſet forth in my defence of free-thinking, for inſtance, in Sect. xxxvi. Wherein I entreat my antagoniſt to explain "whether Sir *Iſaac*'s momentum be a finite quantity or an infiniteſimal or a mere limit, *adding*, if you ſay a finite quantity, be pleaſed to reconcile this with what he ſaith in the ſcholium of the ſecond lemma of the firſt ſection of the firſt book of his Principles: *Cave intelligas quantitates magnitudine determinatas, ſed cogita ſemper diminuendas ſine limite.* If you ſay an infiniteſimal: reconcile this with what is ſaid in his introduction to the Quadratures: *Volui oſtendere quod in methodo fluxionum non opus ſit figuras infinite parvas in geometriam inducere.* If you ſhould ſay it is a mere limit, be pleaſed to reconcile this with what we find in the firſt caſe of

"the

" the ſecond lemma in the ſecond book of his Principles: *Ubi de lateribus*
" A & B *deerant momentorum dimidia*, &c. where the moments are ſup-
" poſed to be divided." I ſhall ſcarce think it worth my while to beſtow a ſerious thought on any writer who ſhall pretend to maintain Sir *Iſaac*'s doctrine, and yet leave this paſſage without a reply. And the reader, I believe, will think with me that, in anſwer to difficulties diſtinctly propoſed and inſiſted on, to offer nothing but a magiſterial aſſertion is a mere grimace of one who made merry with fluxions, under the notion of defending them. And he will be further confirmed in this way of thinking, when he obſerves that Mr. *Walton* hath not ſaid one ſyllable, in reply to thoſe ſeveral ſections of my defence, which I had particularly referred to, as containing a full anſwer to his Vindication. But it is no wonder if, with Sir *Iſaac*'s doctrine, he ſhould drop alſo his own arguments in favour thereof.

XXI. I have been at the pains once for all to write this ſhort comment on Mr. *Walton*, as the only way I could think of for making him intelligible, which will alſo ſerve as a key to his future writings on this ſubject. And I was the rather inclined to take this trouble, becauſe it ſeemeth to me, there is no part of learning that wants to be cleared up more than this ſame doctrine of fluxions, which hath hitherto walked about in a miſt to the ſtupefaction of the literari of the preſent age. To conclude, I accept this profeſſor's recantation, nor am at all diſpleaſed at the ingenious method he takes to diſguiſe it. Some zealous fluxioniſt may perhaps anſwer him.

AN

ESSAY

TOWARDS

Preventing the RUIN of GREAT-BRITAIN.

AN

ESSAY, &c.

WHETHER the proſperity that preceded, or the calamities that ſucceed the South-ſea project have moſt contributed to our undoing, is not ſo clear a point as it is that we are actually undone, and loſt to all ſenſe of our true intereſt; nothing leſs than this could render it pardonable, to have recourſe to thoſe old-faſhioned trite maxims concerning religion, induſtry, frugality, and public ſpirit, which are now forgotten, but if revived and put in practice, may not only prevent our final ruin, but alſo render us a more happy and flouriſhing people than ever.

Religion hath in former days been cheriſhed and reverenced by wiſe patriots and lawgivers, as knowing it to be impoſſible that a nation ſhould thrive and flouriſh without virtue, or that virtue ſhould ſubſiſt without conſcience, or conſcience without religion: inſomuch that an Atheiſt or Infidel was looked on with abhorrence, and treated as an enemy to his country. But in theſe wiſer times, a cold indifference for the national religion, and indeed for all matters of faith and divine worſhip, is thought good ſenſe. It is even become faſhionable to decry religion; and that little talent of ridicule is applied to ſuch wrong purpoſes, that a good chriſtian can hardly keep himſelf in countenance.

Liberty

Liberty is the greateſt human bleſſing that a virtuous man can poſſeſs, and is very conſiſtent with the duties of a good ſubject and a good chriſtian, but the preſent age aboundeth with injudicious patrons of liberty, who not diſtinguiſhing between that and licentiouſneſs, take the ſureſt method to diſcredit what they would ſeem to propagate; for, in effect, can there be a greater affront offered to that juſt freedom of thought and action, which is the prerogative of a rational creature, or can any thing recommend it leſs to honeſt minds, than under colour thereof to obtrude ſcurrility and profaneneſs on the world? But it hath been always obſerved of weak men, that they know not how to avoid one extreme without running into another.

Too many of this ſort paſs upon vulgar readers for great authors, and men of profound thought, not on account of any ſuperiority either in ſenſe or ſtyle, both which they poſſeſs in a very moderate degree, nor of any diſcoveries they have made in arts or ſciences, which they ſeem to be little acquainted with: but purely becauſe they flatter the paſſions of corrupt men, who are pleaſed to have the clamours of conſcience ſilenced, and thoſe great points of the chriſtian religion made ſuſpected, which withheld them from many vices of pleaſure and intereſt, or made them uneaſy in the commiſſion of them.

In order to promote that laudable deſign of effacing all ſenſe of religion from among us, they form themſelves into aſſemblies, and proceed with united counſels and endeavours; with what ſucceſs, and with what merit towards the public, the effect too plainly ſhews; I will not ſay, theſe gentlemen have formed a direct deſign to ruin their country, or that they have the ſenſe to ſee half the ill conſequences, which muſt neceſſarily flow from the ſpreading of their opinions, but the nation feels them, and it is high time the legiſlature put a ſtop to them.

I am

I am not for placing an invidious power in the hands of the clergy, or complying with the narrowneſs of any miſtaken zealots, who ſhould incline to perſecute diſſenters: but whatever conduct, common ſenſe, as well as chriſtian charity obligeth us to uſe, towards thoſe who differ from us in ſome points of religion, yet the public ſafety requireth, that the avowed contemners of all religion ſhould be ſeverely chaſtiſed, and perhaps it may be no eaſy matter to aſſign a good reaſon why blaſphemy againſt God ſhould not be inquired into, and puniſhed with the ſame rigour as treaſon againſt the king.

For though we may attempt to patch up our affairs, yet it will be to no purpoſe, the finger of God will unravel all our vain projects, and make them ſnares to draw us into greater calamities, if we do not reform that ſcandalous libertiniſm which (whatever ſome ſhallow men may think) is our worſt ſymptom and the ſureſt prognoſtic of our ruin.

Induſtry is the natural ſure way to wealth; this is ſo true, that it is impoſſible an induſtrious free people ſhould want the neceſſaries and comforts of life, or an idle enjoy them under any form of government. Money is ſo far uſeful to the public, as it promoteth induſtry, and credit having the ſame effect, is of the ſame value with money; but money or credit circulating thorough a nation from hand to hand without producing labour and induſtry in the inhabitants, is direct gaming.

It is not impoſſible for cunning men to make ſuch plauſible ſchemes, as may draw thoſe who are leſs ſkilful into their own and the public ruin. But ſurely, there is no man of ſenſe and honeſty, but muſt ſee and own, whether he underſtands the game or not, that it is an evident folly for any people, inſtead of proſecuting the old honeſt methods of induſtry and frugality, to ſit down to a public gaming-table, and play off their money one to another.

The

The more methods there are in a ſtate for acquiring riches without induſtry or merit, the leſs there will be of either in that ſtate; this is as evident as the ruin that attends it. Beſides, when money is ſhifted from hand to hand in ſuch a blind fortuitous manner, that ſome men ſhall from nothing in an inſtant acquire vaſt eſtates, without the leaſt deſert; while others are as ſuddenly ſtript of plentiful fortunes, and left on the pariſh by their own avarice and credulity, what can be hoped for on the one hand, but abandoned luxury and wantonneſs, or on the other, but extreme madneſs and deſpair.

In ſhort, all projects for growing rich by ſudden and extraordinary methods, as they operate violently on the paſſions of men, and encourage them to deſpiſe the ſlow moderate gains that are to be made by an honeſt induſtry, muſt be ruinous to the public, and even the winners themſelves will at length be involved in the public ruin.

It is an eaſy matter to contrive projects for the encouragement of induſtry; I wiſh it were as eaſy to perſuade men to put them in practice. There is no country in Europe where there is ſo much charity collected for the poor, and none where it is ſo ill managed. If the poor-tax was fixed at a medium in every pariſh, taken from a calculation of the laſt ten years, and raiſed for ſeven years by act of parliament, that ſum (if the common eſtimate be not very wrong) frugally and prudently laid out in workhouſes, would for ever free the nation from the care of providing for the poor, and at the ſame time conſiderably improve our manufactures. We might by theſe means rid our ſtreets of beggars, even the children, the maimed and the blind, might be put in a way of doing ſomething for their livelihood. As for the ſmall number of thoſe, who by age or infirmities are utterly incapable of all employment, they might be maintained by the labour of others; and the public would receive no

ſmall

ſmall advantage from the induſtry of thoſe, who are now ſo great a burthen and expence to it.

The ſame tax, continued three years longer, might be very uſefully employed in making high roads, and rendering rivers navigable, two things of ſo much profit and ornament to a nation, that we ſeem the only people in Europe who have neglected them *. So that in the ſpace of ten years the public may be for ever freed from a heavy tax, induſtry encouraged, commerce facilitated, and the whole country improved, and all this only by a frugal honeſt management, without raiſing one penny extraordinary.

The number of people is both means and motives to induſtry; it ſhould therefore be of great uſe to encourage propagation, by allowing ſome reward or privilege to thoſe who have a certain number of children; and on the other hand, enacting that the public ſhall inherit half the unintailed eſtates of all who die unmarried of either ſex.

Beſides the immediate end propoſed by the foregoing methods, they furniſh taxes upon paſſengers, and dead batchelors, which are in no ſort grievous to the ſubject, and may be applied towards clearing the public debt, which, all mankind agree, highly concerneth the nation in general, both court and country. *Cæſar* indeed, mentions it as a piece of policy, that he borrowed money from his officers to beſtow it on the ſoldiers, which fixed both to his intereſt, and though ſomething like this may paſs for ſkill at certain junctures in civil government, yet if carried too far, it will prove a dangerous experiment.

There is ſtill room for invention or improvement in moſt trades and manufactures, and it is probable, that præmiums given on that account

* This was publiſhed before Turnpikes were erected.

to ingenious artiſts, would ſoon be repaid an hundred fold to the public. No colour is ſo much wore in *Italy*, *Spain*, and *Portugal* as black; but our black cloth is neither ſo laſting, nor of ſo good a dye as the *Dutch*, which is the reaſon of their engroſſing the profit of that trade; this is ſo true, that I have known *Engliſh* merchants abroad wear black cloth of *Holland* themſelves, and ſell and recommend it as better than that of their own country. It is commonly ſaid the water of *Leyden* hath a peculiar property for colouring black, but it hath been alſo ſaid and paſſed current, that good glaſſes may be made no where but at *Venice*, and there only in the little iſland of *Murano:* which was attributed to ſome peculiar property in the air; and we may poſſibly find other opinions of that ſort to be as groundleſs, ſhould the legiſlature think it worth while to propoſe præmiums in the foregoing, or in the like caſes of general benefit to the public; but I remember to have ſeen, about ſeven years ago, a man pointed at in a coffee-houſe, who (they ſaid) had firſt introduced the right ſcarlet dye among us, by which the nation in general, as well as many private perſons, have ſince been great gainers though he was himſelf a beggar, who, if this be true, deſerved an honourable maintenance from the public.

There are alſo ſeveral manufactures which we have from abroad, that may be carried on to as great perfection here as elſewhere. If it be conſidered that more fine linen is wore in *Great-Britain* than in any other country of *Europe*, it will be difficult to aſſign a reaſon why paper may not be made here as good, and in the ſame quantity, as in *Holland*, or *France*, or *Genoa*. This is a manufacture of great conſumption, and would ſave much to the public. The like may be ſaid of tapeſtry, lace, and other manufactures, which is ſet on foot in cheap parts of the country, would employ many hands, and ſave money to the nation, as well as bring it from abroad. Projects for improving old manufactures, or ſetting up new ones, ſhould not be deſpiſed in a trading country, but the

the making them pretences for ſtockjobbing hath been a fatal impoſition.

As induſtry dependeth upon trade, and this, as well as the public ſecurity, upon our navigation, it concerneth the legiſlature to provide, that the number of our ſailors do not decreaſe, to which it would very much conduce, if a law were made prohibiting the payment of ſailors in foreign parts; for it is uſual with thoſe on board merchantmen as ſoon as they ſet foot on ſhore to receive their pay, which is ſoon ſpent in riotous living; and when they have emptied their pockets, the temptation of a piſtole preſent money, never faileth to draw them into any foreign ſervice. To this (if I may credit the information I have had from ſome *Engliſh* factors abroad) it is chiefly owing, that the *Venetians*, *Spaniards*, and others, have ſo many *Engliſh* on board their ſhips; ſome merchants indeed and maſters of veſſels may make a profit in defrauding thoſe poor wretches, when they pay them in ſtrange coin (which I have been aſſured often amounts to twelvepence in the crown) as well as in ridding themſelves of the charge of keeping them when they ſell their ſhips, or ſtay long in port, but the public loſe both the money and the men; who, if their arrears were to be cleared at home, would be ſure to return, and ſpend them in their own country: it is a ſhame this abuſe ſhould not be remedied.

Frugality of manners is the nouriſhment and ſtrength of bodies politic. It is that by which they grow and ſubſiſt, until they are corrupted by luxury; the natural cauſe of their decay and ruin. Of this we have examples in the *Perſians*, *Lacedæmonians*, and *Romans:* not to mention many later governments which have ſprung up, continued a while, and then periſhed by the ſame natural cauſes. But theſe are, it ſeems, of no uſe to us; and, in ſpite of them, we are in a fair way of becoming ourſelves, another uſeleſs example to future ages.

Men are apt to meaſure national proſperity by riches, it would be righter to meaſure it by the uſe that is made of them. Where they promote an honeſt commerce among men, and are motives to induſtry and virtue, they are without doubt of great advantage; but where they are made (as too often happens) an inſtrument to luxury, they enervate and diſpirit the braveſt people. So juſt is that remark of *Machiavel*, that there is no truth in the common ſaying, money is the nerves of war; and though we may ſubſiſt tolerably for a time among corrupt neighbours, yet if ever we have to do with a hardy, temperate, religious ſort of men, we ſhall find to our coſt, that all our riches are but a poor exchange for that ſimplicity of manners which we deſpiſe in our anceſtors. This ſole advantage hath been the main ſupport of all the republics that have made a figure in the world; and perhaps it might be no ill policy in a kingdom to form itſelf upon the manners of a republic.

Simplicity of manners may be more eaſily preſerved in a republic than a monarchy; but if once loſt, may be ſooner recovered in a monarchy, the example of a court being of great efficacy, either to reform or to corrupt a people; that alone were ſufficient to diſcountenance the wearing of gold or ſilver, either in cloaths or equipage, and if the ſame were prohibited by law, the ſaving ſo much bullion would be the ſmalleſt benefit of ſuch an inſtitution; there being nothing more apt to debaſe the virtue and good ſenſe of our gentry of both ſexes, than the trifling vanity of apparel, which we have learned from *France*, and which hath had ſuch viſible ill conſequences on the genius of that people. Wiſer nations have made it their care to ſhut out this folly by ſevere laws and penalties, and its ſpreading among us can forebode no good, if there be any truth in the obſervation of one of the ancients, that the direct way to ruin a man is to dreſs him up in fine cloaths.

It cannot be denied that luxury of dreſs giveth a light behaviour to our women, which may paſs for a ſmall offence, becauſe it is a common one, but is in truth the ſource of great corruptions. For this very offence the prophet *Iſaiah* denounced a ſevere judgment againſt the ladies of his time. I ſhall give the paſſage at length; "moreover, the LORD ſaith, "becauſe the daughters of *Zion* are haughty, and walk with ſtretched "forth necks and wanton eyes, walking and mincing as they go, and "making a tinkling with their feet; therefore the LORD will ſmite with "a ſcab the crown of the head of the daughters of *Zion*, and the LORD "will diſcover their ſecret parts. In that day the LORD will take away "the bravery of their tinkling ornaments about their feet, and their cauls "and their round tires like the moon, the chains, and the bracelets, and "the mufflers, the bonnets, and the ornaments of the legs, and the "head-bands, and the tablets, and the ear-rings, the rings and noſe-"jewels, the changeable ſuits of apparel, and the mantles, and the wim-"ples, and the criſping pins, the glaſſes, and the fine linen, and the "hoods and the vails. And it ſhall come to paſs that inſtead of a ſweet "ſmell there ſhall be a ſtink; and inſtead of a girdle a rent; and inſtead "of well ſet hair, baldneſs; and inſtead of a ſtomacher, a girding of ſack-"cloth; and burning inſtead of beauty:" The ſcab, the ſtench, and the burning are terrible peſtilential ſymptoms, and our ladies would do well to conſider, they may chance to reſemble thoſe of *Zion*, in their puniſhment as well as their offence.

But dreſs is not the only thing to be reformed, ſumptuary laws are uſeful in many other points. In former times the natural plainneſs and good ſenſe of the *Engliſh* made them leſs neceſſary. But ever ſince the luxurious reign of King *Charles* the ſecond, we have been doing violence to our natures, and are by this time ſo much altered for the worſe, that it is to be feared, the very ſame diſpoſitions that make them neceſſary, will for ever hinder them from being enacted or put in execution.

A private

A private family in difficult circumſtances, all men agree, ought to melt down their plate, walk on foot, retrench the number of their ſervants, wear neither jewels nor rich cloaths, and deny themſelves expenſive diverſions; and why not the public? Had any thing like this been done, our taxes had been leſs, or which is the ſame thing, we ſhould have felt them leſs. But it is very remarkable, that luxury was never at ſo great a height, nor ſpread ſo generally through the nation, as during the expence of the late wars, and the heavy debt that ſtill lyeth upon us.

This vice draweth after it a train of evils which cruelly infeſt the public; faction, ambition, envy, avarice, and that of the worſt kind, being much more hurtful in its conſequences, though not ſo infamous as penury. It was the great art of cardinal *Richelieu*, by encouraging luxury and expence to impoveriſh the *French* nobility, and render them altogether dependent on the crown, which hath been ſince very ſucceſsfully effected. Theſe and many more conſiderations ſhew the neceſſity there is for ſumptuary laws, nor can any thing be ſaid againſt them in this iſland, which might not with equal force be objected in other countries, which have nevertheleſs judged the public benefit of ſuch inſtitutions, to be of far greater importance than the ſhort ſufferings of a few, who ſubſiſt by the luxury of others.

It is evident, that old taxes may be better born, as well as new ones raiſed by ſumptuary laws judiciouſly framed, not to damage our trade, but retrench our luxury. It is evident, that for want of theſe, luxury (which like the other faſhions, never faileth to deſcend) hath infected all ranks of people, and that this enableth the *Dutch* and *French* to underſell us, to the great prejudice of our traffic. We cannot but know that in our preſent circumſtances, it ſhould be our care, as it is our intereſt, to make poverty tolerable; in ſhort, we have the experience of many ages to convince us, that a corrupt luxurious people muſt of themſelves fall into

into ſlavery, although no attempt be made upon them. Theſe and the like obvious reflections ſhould, one would think, have forced any people in their ſenſes upon frugal meaſures.

But we are doomed to be undone. Neither the plain reaſon of the thing, nor the experience of paſt ages, nor the examples we have before our eyes, can reſtrain us from imitating, not to ſay ſurpaſſing, the moſt corrupt and ruined people, in thoſe very points of luxury that ruined them. Our gaming, our operas, our maſquerades, are, in ſpite of our debts and poverty, become the wonder of our neighbours. If there be any man ſo void of all thought and common ſenſe, as not to ſee where this muſt end, let him but compare what *Venice* was at the league of *Cambray*, with what it is at preſent, and he will be convinced, how truly thoſe faſhionable paſtimes are calculated to depreſs and ruin a nation.

But neither *Venice* nor *Paris*, nor any other town in any part of the world, ever knew ſuch an expenſive ruinous folly as our maſquerade. This alone is ſufficient to inflame and ſatisfy the ſeveral appetites for gaming, dreſſing, intriguing, luxurious eating and drinking. It is a moſt ſkilful abridgment, the very quinteſſence, the abſtract of all thoſe ſenſeleſs vanities, that have ever been the ruin of fools and deteſtation of wiſe men. And all this under the notion of an elegant entertainment, hath been admitted among us; though it be in truth a contagion of the worſt kind. The plague, dreadful as it is, is an evil of ſhort duration; cities have often recovered and flouriſhed after it; but when was it known that a people broken and corrupt by luxury recovered themſelves? Not to ſay, that general corruption of manners never faileth to draw after it ſome heavy judgment of war, famine, or peſtilence. Of this we have a freſh inſtance in one of the moſt debauched towns of Europe *, and no body knows how ſoon it may be our own caſe. This elegant entertainment

* Marſeilles.

is

is indeed ſuſpended for the preſent, but there remains ſo ſtrong a propenſion towards it, that, if the wiſdom of the legiſlature does not interpoſe, it will ſoon return with the additional temptation of having been forbid for a time. It were ſtupid and barbarous to declaim againſt keeping up the ſpirit of the people by proper diverſions, but then they ſhould be proper, ſuch as poliſh and improve their minds, or increaſe the ſtrength and activity of their bodies; none of which ends are anſwered by the maſquerade, no more than by thoſe *French* and *Italian* follies, which, to our ſhame, are imported and encouraged at a time, when the nation ought to be too grave for ſuch trifles.

It is not to be believed, what influence public diverſions have on the ſpirit and manners of a people. The *Greeks* wiſely ſaw this, and made a very ſerious affair of their public ſports. For the ſame reaſon, it will perhaps ſeem worthy the care of our legiſlature, to regulate the public diverſions, by an abſolute prohibition of thoſe which have a direct tendency to corrupt our morals, as well as by a reformation of the drama; which, when rightly managed, is ſuch a noble entertainment, and gave thoſe fine leſſons of morality and good ſenſe to the *Athenians* of old, and to our *Britiſh* gentry above a century ago; but for theſe laſt ninety years, hath entertained us, for the moſt part, with ſuch wretched things as ſpoil, inſtead of improving the taſte and manners of the audience. Thoſe who are attentive to ſuch propoſitions only, as may fill their pockets, will probably ſlight theſe things as trifles below the care of the legiſlature. But I am ſure, all honeſt thinking men muſt lament to ſee their country run headlong into all thoſe luxurious follies, which, it is evident, have been fatal to other nations, and will undoubtedly prove fatal to us alſo, if a timely ſtop be not put to them

Public ſpirit, that glorious principle of all that is great and good, is ſo far from being cheriſhed or encouraged, that it is become ridiculous in this

this enlightened age, which is taught to laugh at every thing that is ſerious as well as ſacred. The ſame atheiſtical narrow ſpirit, centring all our cares upon private intereſt, and contracting all our hopes within the enjoyment of this preſent life, equally produceth a neglect of what we owe to God and our country. *Tully* hath long ſince obſerved, " that it " is impoſſible for thoſe, who have no belief of the immortality of the " ſoul or a future ſtate of rewards and puniſhments, to ſacrifice their " particular intereſts and paſſions to the public good, or have a generous " concern for poſterity," and our own experience confirmeth the truth of this obſervation.

In order therefore to recover a ſenſe of public ſpirit, it is to be wiſhed that men were firſt affected with a true ſenſe of religion; *pro aris & focis*, having ever been the great motive to courage and perſeverance in a public cauſe.

It would likewiſe be a very uſeful policy, and warranted by the example of the wiſeſt governments, to make the natural love of ſame and reputation ſubſervient to promoting that noble principle. Triumphal arches, columns, ſtatues, inſcriptions, and the like monuments of public ſervices, have in former times been found great incentives to virtue and magnanimity, and would probably have the ſame effects on *Engliſhmen* which they have had on *Greeks* and *Romans*. And perhaps, a pillar of infamy would be found a proper and exemplary puniſhment in caſes of ſignal public villany, where the loſs of fortune, liberty, or life, are not proportioned to the crime; or, where the ſkill of the offender, or the nature of his offence, may ſkreen him from the letter of the law.

Several of theſe are to be ſeen at *Genoa*, *Milan*, and other towns of *Italy*, where it is the cuſtom to demoliſh the houſe of a citizen, who hath conſpired the ruin of his country, or been guilty of any enormous crime

towards the public, and in place thereof to erect a monument of the crime, and criminal deſcribed, in the blackeſt manner. We have nothing of this ſort, that I know, but that which is commonly called the monument, which in the laſt age was erected for an affair no way more atrocious than the modern unexampled attempt * of men eaſy in their fortunes, and unprovoked by hardſhips of any ſort, in cool blood, and with open eyes to ruin their native country. This fact will never be forgotten, and it were to be wiſhed that with it the public deteſtation thereof may be tranſmitted to poſterity, which would in ſome meaſure vindicate the honour of the preſent, and be a uſeful leſſon to future ages.

Thoſe noble arts of architecture, ſculpture, and painting, do not only adorn the public, but have alſo an influence on the minds and manners of men, filling them with great ideas, and ſpiriting them up to an emulation of worthy actions. For this cauſe they were cultivated and encouraged by the *Greek* cities, who vied with each other in building and adorning their temples, theatres, porticos, and the like public works, at the ſame time that they diſcouraged private luxury; the very reverſe of our conduct.

To propoſe the building a parliament houſe, courts of juſtice, royal palace, and other public edifices, ſuitable to the dignity of the nation, and adorning them with paintings and ſtatues, which may tranſmit memorable things and perſons to poſterity, would probably be laughed at as a vain affair, of great expence, and little uſe to the public; and it muſt be owned, we have reduced ourſelves to ſuch ſtraits, that any propoſition of expence ſuiteth ill with our preſent circumſtances. But how proper ſoever this propoſal may be for the times, yet it comes ſo properly into a diſcourſe of public ſpirit, that I could not but ſay ſomething of it. And at another time it will not ſeem unreaſonable, if we conſider that it is no

* The South-ſea project.

more

more than the wiſeſt nations have done before us, that it would ſpirit up new arts, employ many hands, keep the money circulating at home, and laſtly, that it would be a notable inſtance of public ſpirit, as well as a motive to it.

The ſame noble principle may be alſo encouraged by erecting an academy of ingenious men, whoſe employment it would be to compile the hiſtory of *Great-Britain*, to make diſcourſes proper to inſpire men with a zeal for the public, and celebrate the memory of thoſe who have been ornaments to the nation, or done it eminent ſervice. Not to mention that this would improve our language, and amuſe ſome buſy ſpirits of the age; which perhaps, would be no ill policy.

This is not without example; for to ſay nothing of the *French* academy, which is proſtituted to meaner purpoſes, it hath been the cuſtom of the *Venetian* ſenate, to appoint one of their order to continue the hiſtory of the republic. This was introduced in the flouriſhing ſtate of that people, and is ſtill in force. We fall ſhort of other nations in the number of good hiſtorians, though no nation in Chriſtendom hath produced greater events, or more worthy to be recorded. The *Athenian* ſenate appointed orators to commemorate annually, thoſe who died in defence of their country, which ſolemnity was performed at the monuments erected in honour of them by the public; and the panegyrics, compoſed by *Iſocrates* and *Pericles*, as well as many paſſages in *Tully*, inform us with what pleaſure the ancient orators uſed to expatiate in praiſe of their country.

Concord and union among ourſelves is rather to be hoped for, as an effect of public ſpirit, than propoſed as a means to promote it. Candid, generous men, who are true lovers of their country, can never be enemies to one half of their countrymen, or carry their reſentments ſo far

as to ruin the public for the ſake of a party. Now I have fallen upon the mention of our parties, I ſhall beg leave to inſert a remark or two, for the ſervice both of whig and tory, without entering into their reſpective merits. Firſt, it is impoſſible for either party to ruin the other, without involving themſelves and their poſterity in the ſame ruin. Secondly, it is very feaſible for either party to get the better of the other, if they could firſt get the better of themſelves; and inſtead of indulging the little womaniſh paſſions of obſtinacy, reſentment, and revenge, ſteadily promote the true intereſt of their country, in thoſe great clear points of piety, induſtry, ſobriety of manners, and an honeſt regard for poſterity; which, all men of ſenſe agree, are eſſential to public happineſs. There would be ſomething ſo great and good in this conduct, as muſt neceſſarily overbear all calumny and oppoſition. But that men ſhould act reaſonably, is rather to be wiſhed than hoped.

I am well aware, that to talk of public ſpirit, and the means of retrieving it, muſt, to narrow ſordid minds, be matter of jeſt and ridicule, how conformable ſoever it be to right reaſon, and the maxims of antiquity. Though one would think, the moſt ſelfiſh men might ſee it was their intereſt to encourage a ſpirit in others, by which they, to be ſure, muſt be gainers. Yet ſuch is the corruption and folly of the preſent age, that a public ſpirit is treated like ignorance of the world, and want of ſenſe; and all the reſpect is paid to cunning men, who bend and wreſt the public intereſt to their own private ends, that in other times hath been thought due to thoſe who were generous enough to ſacrifice their private intereſt to that of their country.

Such practices and ſuch maxims as theſe muſt neceſſarily ruin a ſtate. But if the contrary ſhould prevail, we may hope to ſee men in power prefer the public wealth, and ſecurity to their own, and men of money make free gifts, or lend it without intereſt to their country. This, how ſtrange

ſtrange and incredible ſoever it may ſeem to us, hath been often done in other ſtates. And the natural *Engliſh* temper conſidered, together with the force of example, no one can tell how far a propoſal for a free gift may go among the monied men, when ſet on foot by the legiſlature, and encouraged by the example of two or three men of figure, who have the ſpirit to do a generous thing, and the underſtanding to ſee it is every private man's intereſt to ſupport that of the public.

If they who have their fortunes in money ſhould make a voluntary gift, the public would be eaſed, and at the ſame time maintain its credit. Nor is a generous love of their country the only motive that ſhould induce them to this. Common equity requires, that all ſubjects ſhould equally ſhare the public burthen. And common ſenſe ſhews, that thoſe who are foremoſt in the danger, ſhould not be the moſt backward in contributing to prevent it.

Before I leave this ſubject, I cannot but take notice of that moſt infamous practice of bribery, than which nothing can be more oppoſite to public ſpirit, ſince every one who takes a bribe plainly owns, that he prefers his private intereſt to that of his country. This corruption is become a national crime, having infected the loweſt as well as the higheſt among us, and is ſo general and notorious, that, as it cannot be matched in former ages, ſo it is to be hoped it will not be imitated by poſterity.

This calls to mind another national guilt, which we poſſeſs in a very eminent degree; there being no nation under the ſun, where ſolemn perjury is ſo common, or where there are ſuch temptations to it. The making men ſwear ſo often in their own caſes, and where they have an intereſt to conceal the truth, hath gradually wore off that awful reſpect which was once thought due to an appeal to Almighty God; inſomuch, that men now-a-days break their faſt and a cuſtom-houſe oath with the ſame

ſame peace of mind. It is a policy peculiar to us, the obliging men to perjure or betray themſelves, and hath had no one good effect, but many very ill ones. Sure I am, that other nations, without the hundredth part of our ſwearing, contrive to do their buſineſs, at leaſt as well as we do. And perhaps our legiſlature will think it proper to follow their example. For whatever meaſures are taken, ſo long as we lie under ſuch a load of guilt, as national perjury and national bribery, it is impoſſible we can proſper.

This poor nation hath ſorely ſmarted of late, and to eaſe the preſent ſmart, a ſudden remedy (as is uſual in ſuch caſes) hath been thought of. But we muſt beware not to miſtake an anodyne for a cure. Where the vitals are touched, and the whole maſs of humours vitiated, it is not enough to eaſe the part pained, we muſt look further, and apply general correctives; otherwiſe the ill humour may ſoon ſhew itſelf in ſome other part.

The South-ſea affair, how ſenſible ſoever, is not the original evil, or the great ſource of our misfortunes, it is but the natural effect of thoſe principles, which for many years have been propagated with great induſtry. And as a ſharp diſtemper, by reclaiming a man from intemperance, may prolong his life, ſo it is not impoſſible but this public calamity that lies ſo heavy on the nation may prevent its ruin. It would certainly prove the greateſt of bleſſings, if it ſhould make all honeſt men of one party; if it ſhould put religion and virtue in countenance, reſtore a ſenſe of public ſpirit, and convince men it is a dangerous folly to purſue private aims in oppoſition to the good of their country, if it ſhould turn our thoughts from gouſenage and ſtock-jobbing, to induſtry and frugal methods of life; in fine, if it ſhould revive and inflame that native ſpark of *Britiſh* worth and honour, which hath too long lain ſmothered and oppreſſed.

With

With this view I have, among ſo many projects for remedying the ill ſtate of our affairs in a particular inſtance, ventured to publiſh the foregoing general hints, which as they have been thrown together from a zeal for the public good, ſo I heartily wiſh they may be regarded neither more nor leſs, than as they are fitted to promote that end.

Though it muſt be owned, that little can be hoped if we conſider the corrupt degenerate age we live in. I know it is an old folly to make peeviſh complaints of the times, and charge the common failures of human nature on a particular age. One may nevertheleſs venture to affirm, that the preſent hath brought forth new and portentous villanies, not to be paralleled in our own or any other hiſtory. We have been long preparing for ſome great cataſtrophe. Vice and villany have by degrees grown reputable among us; our infidels have paſſed for fine gentlemen, and our venal traitors for men of ſenſe, who knew the world. We have made a jeſt of public ſpirit, and cancelled all reſpect for whatever our laws and religion repute ſacred. The old *Engliſh* modeſty is quite worn off, and inſtead of bluſhing for our crimes, we are aſhamed only of piety and virtue. In ſhort, other nations have been wicked, but we are the firſt who have been wicked upon principle.

The truth is, our ſymptoms are ſo bad, that notwithſtanding all the care and vigilance of the legiſlature, it is to be feared the final period of our ſtate approaches. Strong conſtitutions, whether politic or natural, do not feel light diſorders. But, when they are ſenſibly affected, the diſtemper is for the moſt part violent and of an ill prognoſtic. Free governments like our own were planted by the *Goths* in moſt parts of *Europe*; and though we all know what they are come to, yet we ſeem diſpoſed rather to follow their example, than to profit by it.

Whether

Whether it be in the order of things, that civil ſtates, ſhould have, like natural products, their ſeveral periods of growth, perfection, and decay; or whether it be an effect, as ſeems more probable, of human folly, that as induſtry produces wealth, ſo wealth ſhould produce vice, and vice ruin.

God grant the time be not near, when men ſhall ſay, 'this iſland was 'once inhabited by a religious, brave, ſincere people, of plain uncorrupt 'manners, reſpecting inbred worth rather than titles and appearances, 'aſſertors of liberty, lovers of their country, jealous of their own rights, 'and unwilling to infringe the rights of others; improvers of learning 'and uſeful arts, enemies to luxury, tender of other men's lives, and 'prodigal of their own; inferior in nothing to the old *Greeks* or *Romans*, 'and ſuperior to each of thoſe people in the perfections of the other. 'Such were our anceſtors during their riſe and greatneſs; but they de-'generated, grew ſervile flatterers of men in power, adopted epicurean 'notions, became venal, corrupt, injurious, which drew upon them the 'hatred of God and man, and occaſioned their final ruin.'

A

DISCOURSE

ADDRESSED TO

MAGISTRATES

AND

MEN in AUTHORITY.

OCCASIONED

By the enormous Licence, and Irreligion of the Times.

A

DISCOURSE, &c.

THE pretenſions and diſcourſe of men, throughout theſe kingdoms, would, at firſt view, lead one to think the inhabitants were all politicians; and yet, perhaps, political wiſdom hath, in no age or country, been more talked of and leſs underſtood. Licence is taken for the end of government, and popular humour for its origin. No reverence for the laws, no attachment to the conſtitution, little attention to matters of conſequence, and great altercation upon trifles, ſuch idle projects about religion and government, as if the public had both to chuſe, a general contempt of all authority, divine and human, an indifference about the prevailing opinions, whether they tend to produce order or diſorder, to promote the empire of God or the devil: theſe are the ſymptoms that ſtrongly mark the preſent age; and this, could never have been the caſe, if a neglect of religion had not made way for it.

When the *Jews* accuſed *Paul* upon religious matters and points of their law, before *Gallio*, the *Roman* magiſtrate; it is ſaid, that Gallio *cared for none of thoſe things.* And, it is to be feared, there are not a few magiſtrates in this chriſtian country who think with the ſame indifference on the ſubject of religion. Herein, nevertheleſs, they judge amiſs, and are much wanting to their duty. For, although it be admitted, that the magiſtrate's peculiar object, is the temporal welfare of the ſtate; yet, this

will by no means exclude a proper care about the prevailing notions and opinions of religion, which influence the lives and actions of men, and have therefore a mighty effect on the public. Men's behaviour is the conſequence of their principles. Hence it follows, that in order to make a ſtate thrive and flouriſh, care muſt be taken, that good principles be propagated in the minds of thoſe who compoſe it.

It would be vain, to depend on the outward form, the conſtitution and ſtructure of a ſtate; while the majority are ever governed by their inward ways of thinking, which at times will break out and ſhew themſelves paramount to all laws and inſtitutions whatſoever. It muſt be great folly therefore to overlook notions, as matters of ſmall moment to the ſtate; while experience ſhews there is nothing more important; and that a prevailing diſorder in the principles and opinions of its members, is ever dangerous to ſociety, and capable of producing the greateſt public evils.

Man is an animal, formidable both from his paſſions and his reaſon; his paſſions often urging him to great evils, and his reaſon furniſhing means to atchieve them. To tame this animal, and make him amenable to order, to inure him to a ſenſe of juſtice and virtue, to with-hold him from ill courſes by fear, and encourage him in his duty by hopes; in ſhort, to faſhion and model him for ſociety, hath been the aim of civil and religious inſtitutions; and in all times, the endeavour of good and wiſe men. The apteſt method for attaining this end, hath been always judged a proper education.

If men's actions are an effect of their principles, that is, of their notions, their belief, their perſuaſions; it muſt be admitted, that principles early ſown in the mind, are the ſeeds which produce fruit and harveſt in the ripe ſtate of manhood. How lightly ſoever ſome men may ſpeak of notions, yet ſo long as the ſoul governs the body, men's notions muſt influence

fluence their actions, more or leſs, as they are ſtronger or weaker; and to good or evil, as they are better or worſe.

Our notions and opinions are a conſtant check on our appetites, and balance to our paſſions; and, although they may not in every inſtance control and rule, yet they will never fail, ſtrongly to affect both the one and the other. What is it that bridles the impetuous deſires of men? That reſtrains them when they are driven by the moſt violent paſſions? In a word, what is it that renders this world habitable, but the prevailing notions of order, virtue, duty and providence? Some, perhaps, may imagine, that the eye of the magiſtrate alone, is ſufficient to keep mankind in awe. But, if every man's heart was ſet to do all the miſchief his appetite ſhould prompt him to do, as often as opportunity and ſecrecy preſented themſelves, there could be no living in the world.

And although too many of thoſe intruſted with civil power, in theſe our days, may be ſaid with Gallio, *to care for none of thoſe things*; and many more who would paſs for men of judgment and knowledge, may look on notions early imbibed, before their grounds and reaſons are apprehended or underſtood, to be but mere prejudices; yet this will detract nothing from their truth and uſefulneſs. To place this matter in a due light, I propoſe to ſhew, that a ſyſtem of ſalutary notions, is abſolutely neceſſary to the ſupport of every civil conſtitution. I ſhall enforce this point, by the teſtimony of thoſe who are eſteemed the wiſeſt men; and, I ſhall make ſome remarks on the modern prevailing ſpirit, and the tendency of the maxims of our times.

Order is neceſſary, not only to the well-being, but to the very being of a ſtate. Now, order and regularity in the actions of men, is not an effect of appetite or paſſion, but of judgment: and the judgment is governed by notions or opinions. There muſt therefore, of neceſſity, in every

every ſtate, be a certain ſyſtem of ſalutary notions, a prevailing ſet of opinions, acquired either by private reaſon and reflection, or taught and inſtilled by the general reaſon of the public; that is, by the law of the land. True it is, that where men either cannot, or will not, uſe their own reaſon, think and examine for themſelves; in ſuch caſe, the notions taught or inſtilled into their minds are embraced rather by the memory, than the judgment. Nor will it be any objection to ſay, that theſe are prejudices; inaſmuch as they are therefore neither leſs uſeful, nor leſs true, although their proofs may not be underſtood by all men.

Licentious habits of youth give a caſt or turn to age: the young rake makes an old infidel: libertine practices beget libertine opinions: and a vicious life generally ends in an old age of prejudice not to be conquered by reaſoning. Of this we ſee inſtances even in perſons celebrated for parts, and who reaſon admirably on other points where they are not biaſſed; but on the ſubject of religion obtrude their gueſſes, ſurmiſes, and broken hints for arguments. Againſt ſuch there is no reaſoning.

Prejudices are notions, or opinions, which the mind entertains without knowing the grounds and reaſons of them, and which are aſſented to without examination. The firſt notions which take poſſeſſion of the minds of men, with regard to duties ſocial, moral, and civil, may therefore be juſtly ſtyled prejudices. The mind of a young creature cannot remain empty; if you do not put into it that which is good, it will be ſure to receive that which is bad.

Do what you can, there will ſtill be a bias from education; and if ſo, is it not better this bias ſhould lie towards things laudable and uſeful to ſociety? This bias ſtill operates, although it may not always prevail. The notions firſt inſtilled, have the earlieſt influence, take the deepeſt root, and generally are found to give a colour and complexion to the ſubſequent

lives

lives of men, inaſmuch as they are in truth, the great ſource of human actions. It is not gold, or honour, or power, that move men to act, but the opinions they entertain of thoſe things. Hence it follows, that if a magiſtrate ſhould ſay, no matter what notions men embrace, I will take heed to their actions; therein he ſhews his weakneſs; for, ſuch as are men's notions, ſuch will be their deeds.

For a man to do, as he would be done by; to love his neighbour as himſelf; to honour his ſuperiors; to believe that God ſcans all his actions, and will reward or puniſh them; and to think, that he who is guilty of falſhood, or injuſtice, hurts himſelf more than any one elſe: are not theſe ſuch notions, and principles, as every wiſe governor, or legiſlator, would covet above all things, to have firmly rooted in the mind of every individual under his care? This is allowed, even by the enemies of religion, who would fain have it thought the offspring of ſtate policy, honouring its uſefulneſs at the ſame time that they diſparage its truth. What, therefore, cannot be acquired by every man's reaſoning, muſt be introduced by precept, and riveted by cuſtom; that is to ſay, the bulk of mankind muſt, in all civilized ſocieties, have their minds by timely inſtruction, well ſeaſoned and furniſhed with proper notions, which, although the grounds or proofs thereof be unknown to them, will nevertheleſs influence their conduct, and ſo far render them uſeful members of the ſtate. But, if you ſtrip men of theſe their notions, or, if you will, prejudices, with regard to modeſty, decency, juſtice, charity, and the like; you will ſoon find them ſo many monſters, utterly unfit for human ſociety.

I deſire it may be conſidered, that moſt men want leiſure, opportunity, or faculties, to derive concluſions from their principles, and eſtabliſh morality on a foundation of human ſcience. True it is, (as St. *Paul* obſerves) that *the inviſible things of God from the creation of the world, are*

are clearly ſeen *. And from thence the duties of natural religion may be diſcovered. But theſe things are ſeen and diſcovered by thoſe alone who open their eyes, and look narrowly for them. Now, if you look throughout the world, you ſhall find but few of theſe narrow inſpectors and inquirers, very few who make it their buſineſs to analyze opinions and purſue them to their rational ſource, to examine whence truths ſpring, and how they are inferred. In ſhort, you ſhall find all men full of opinions, but knowledge only in a few.

It is impoſſible from the nature and circumſtances of human kind, that the multitude ſhould be philoſophers, or that they ſhould know things in their cauſes. We ſee every day, that the rules, or concluſions alone, are ſufficient for the ſhop-keeper to ſtate his account, the ſailor to navigate his ſhip, or the carpenter to meaſure his timber; none of which underſtand the theory; that is to ſay, the grounds and reaſons either of arithmetic or geometry. Even ſo in moral, political and religious matters, it is manifeſt, that the rules and opinions early imbibed at the firſt dawn of underſtanding, and without the leaſt glimpſe of ſcience, may yet produce excellent effects, and be very uſeful to the world: and that in fact they are ſo, will be very viſible to every one who ſhall obſerve what paſſeth round about him.

It may not be amiſs to inculcate, that the difference between prejudices and other opinions doth not conſiſt in this; that the former are falſe, and the latter true; but in this, that the former are taken upon truſt, and the latter acquired by reaſoning. He, who hath been taught to believe the immortality of the ſoul, may be as right in his notion, as he who hath reaſoned himſelf into that opinion. It will then by no means follow, that becauſe this or that notion is a prejudice, it muſt be

* Rom. ch. 1. ver. 20.

therefore

therefore falſe. The not diſtinguiſhing between prejudices and errors, is a prevailing overſight among our modern free-thinkers.

There may be, indeed, certain mere prejudices or opinions, which having no reaſons either aſſigned or aſſignable, to ſupport them, are nevertheleſs entertained by the mind, becauſe they intruded betimes into it. Such may be ſuppoſed falſe, not becauſe they were early learned, or learned without their reaſons; but becauſe there are in truth no reaſons to be given for them.

Certainly, if a notion may be concluded falſe, becauſe it was early imbibed, or becauſe it is with moſt men an object of belief rather than of knowledge, one may by the ſame reaſoning, conclude ſeveral propoſitions of *Euclid* to be falſe. A ſimple apprehenſion of concluſions as taken in themſelves, without the deductions of ſcience, is what falls to the ſhare of mankind in general. Religious awe, the precepts of parents and maſters, the wiſdom of legiſlators, and the accumulated experience of ages, ſupply the place of proofs and reaſonings with the vulgar of all ranks: I would ſay, that diſcipline, national conſtitution, and laws human or divine, are ſo many plain land marks, which guide them into the paths wherein it is preſumed they ought to tread.

From what hath been premiſed, it plainly appears, that in the bulk of mankind, there are, and muſt be prejudices; that is, opinions taken upon truſt; or, in other words, that there are points of faith among all men whatſoever, as well as among chriſtians.

And, as it is evident, that the unthinking part of every age, ſex, and condition among us, muſt neceſſarily receive notions with the ſubmiſſion of faith; ſo it is very reaſonable, that they ſhould ſubmit their faith to the greateſt authorities human and divine, the law and the goſpel. But,

if once all reverence for theſe be deſtroyed, our pretenders to moral knowledge will have no authority to imbue the multitude with ſuch notions as may control their appetites. From all which it follows, that the modern ſchemes of our free-thinkers, who pretend to ſeparate morality from religion, how rational ſoever they may ſeem to their admirers, are, in truth and effect, moſt irrational and pernicious to civil ſociety.

Let any one, who thinks at all, conſider the ſavage ſtate of undiſciplined men, whoſe minds are nurtured to no doctrine, broke by no inſtruction, governed by no principle. Let him at the ſame time reflect on a ſociety of perſons educated in the principles of our church, formed betimes to fear God, to reverence their ſuperiors, to be grateful to their benefactors, forgiving to their enemies, juſt and charitable to all men; and he will then be able to judge of the merits of thoſe who are ſo active to weed out the prejudices of education.

Among the many wild notions broached in theſe giddy times, it muſt be owned, that ſome of our declaimers againſt prejudice, have wrought themſelves into a ſort of eſteem for ſavages, as a virtuous and unprejudiced people. In proof of which, they allege their being free from many vices practiſed in civilized nations. Now, it is very true, among ſavages there are few inſtances to be found of luxury, avarice, or ambition; not that the contrary virtues take place, but becauſe the opportunities and faculties for ſuch vices, are wanting. For the ſame reaſon you do not ſee them in brutes.

What they eſteem and admire in thoſe creatures, is not innocence, but ignorance; it is not virtue, but neceſſity. Give them but the means of tranſgreſſing, and they know no bounds. For example: ſupply the water-drinking ſavage with ſtrong liquor, and he ſhall be drunk for ſeveral days and nights together. Again; we admit an uneducated ſavage knows not

not how to ſupplant a rival with the refined treachery of a courtier; yet, if you put his foe once in his power, you ſhall ſoon ſee what a horrible reliſh and delight the monſter hath in cruelty.

Above all others, religious notions, or if you will, prejudices, (ſince this, as hath been already obſerved, detracts nothing from their truth and uſefulneſs) have the moſt influence, they are the ſtrongeſt curb from vice, and the moſt effectual ſpur to worthy conduct. And indeed, whether we conſider the reaſon of things, or the practice of men in all times, we ſhall be ſatisfied, that nothing truly great and good, can enter into the heart of one attached to no principles of religion, who believes no Providence, who neither fears hell, nor hopes for heaven.

Puniſhments and rewards have always had, and always will have the greateſt weight with men; and the moſt conſiderable of both kinds are propoſed by religion, the duties whereof fall in with the views of the civil magiſtrate; it undeniably follows, that nothing can add more ſtrength to a good and righteous government, than religion. Therefore it mainly concerns governors to keep an attentive eye on the religion of their ſubjects. And indeed, it is one leſſon to magiſtrate and people, prince and ſubject, *Keep my commandments and live, and my law as the apple of thine eye* *.

Although it is no conſequence from what hath been ſaid, that men ſhould be debarred the free uſe of reaſon and inquiry; yet, ſurely it will follow, that without good reaſon, a man ſhould not reject thoſe notions which have been inſtilled by the laws and education of his country. And even they who think they have ſuch reaſon, have nevertheleſs no right of dictating † to others. It is true, divine authority is ſuperior to all hu-

* Prov. ch. vii. ver. 3.

† Though a man's private judgment be a rule to himſelf, it will not thence follow, that he hath any right to ſet it up for a rule to others.

man prejudices, inſtitutions and regards whatſoever. And it is wiſe, although at the riſk of liberty, or life, to obey God rather than man. But our modern reformers of prejudice, have nothing to plead * of that kind.

There is no magiſtrate ſo ignorant as not to know that power, phyſical power, reſides in the people; but authority is from opinion, which authority is neceſſary to reſtrain and direct the people's power, and therefore religion is the great ſtay and ſupport of a ſtate. Every religion that inculcates virtue, and diſcourageth vice, is ſo far of public benefit. The chriſtian religion doth not only this, but further makes every legal conſtitution ſacred by commanding our ſubmiſſion thereto. *Let every ſoul be ſubject to the higher powers*, ſaith St. Paul, *for the powers that be, are ordained of God* †. And, in effect, for ſeveral years paſt, while the reverence for our church and religion, hath been decaying and wearing off from the minds of men, it may be obſerved, that loyalty hath in proportion loſt ground; and now the very word ſeems quite forgotten. Submiſſion for conſcience, as well as for wrath, was once reckoned an uſeful leſſon; but now, with other good leſſons, is laid aſide as an obſolete prejudice.

That prince or magiſtrate, however great or powerful, who thinks his own authority ſufficient to make him reſpected and obeyed, lies under a woful miſtake, and never fails to feel it ſooner or later. Obedience to all civil power is rooted in the religious fear of God; it is propagated, preſerved and nouriſhed by religion. This makes men obey, not with eye-ſervice, but in ſincerity of heart. Human regards may reſtrain men from open and penal offences; but the fear of God is a reſtraint from all degrees of all crimes, however circumſtanced. Take away this ſtay and prop of duty, this root of civil authority; and all that was ſuſtained by

* No man can ſay he is obliged in conſcience, honour, or prudence, to inſult the public wiſdom, or to ridicule the laws under whoſe protection he lives.

† Rom. ch. xiii. ver. 1.

it,

it, or grew from it, ſhall ſoon languiſh. The authority, the very being of the magiſtrate, will prove a poor and precarious thing.

An inward ſenſe of the ſupreme majeſty of the King of kings, is the only thing that can beget and preſerve a true reſpect for ſubordinate majeſty in all the degrees of power, the firſt link of authority being fixed at the throne of God. But in theſe our days, that *majeſtas imperii*, that ſacredneſs of character, which rooted in a religious principle, was the great guard and ſecurity of the ſtate, is through want thereof become the public ſcorn. And indeed, what hold can the prince or magiſtrate have on the conſcience of thoſe who have no conſcience? How can he build on the principles of ſuch as have no principles? Or how can he hope for reſpect where God himſelf is neglected?

It is manifeſt, that no prince upon earth can hope to govern well, or even to live eaſy and ſecure, much leſs reſpected by his people, if he do not contribute by his example and authority, to keep up in their minds an awful ſenſe of religion. As for a moral ſenſe and moral fitneſs, or eternal relations, how inſufficient thoſe things are for eſtabliſhing general and juſt notions of morality, or for keeping men within due bounds, is ſo evident from fact and experience, that I need not now enter into a particular diſquiſition about them *.

It muſt be owned, that the claws of rapine and violence, may in ſome degree be pared and blunted by the outward polity of a ſtate. But ſhould we not rather try, if poſſible, to pull them quite out? The evil effects of wickedneſs may be often redreſſed by public juſtice. But would it not be better to heal the ſource, and by an inward principle, extirpate wickedneſs from the heart, rather than depend altogether on human laws for preventing or redreſſing the bad effects thereof? 'I might (ſaid the

* See ALCIPHRON, Dial. III. and IV.

Chineſe

'*Chineſe* Doctor *Confucius*) hear and decide controverſies as well as ano-
'ther: but, what I would have, is, that men ſhould be brought to ab-
'ſtain from controverſies, out of an inward love and regard for each
'other.' *

Too many in this age of free remarks and projects, are delighted with republican ſchemes, and imagine they might remedy whatever was amiſs, and render a people great and happy, merely by a new plan or form of government. This dangerous way of thinking and talking, is grown familiar, through the fooliſh † freedom of the times. But, alas! thoſe men do not ſeem to have touched either the true cauſe or cure of public evils. Be the plan ever ſo excellent, or the architects ever ſo able, yet no man in his wits would undertake to build a palace with mere mud or dirt. There muſt be fit materials; and without a religious principle, men can never be fit materials for any ſociety, much leſs for a republic. Religion is the centre which unites, and the cement which connects the ſeveral parts or members of the political body. Such it hath been held by all wiſe men, from the remoteſt times, down to our ingenious contemporaries; who, if they are in the right, it muſt be admitted that all the reſt of the world have been in the wrong.

From the knowledge of its being abſolutely neceſſary to the government of a ſtate, that the hearts and minds of the people be inwardly imbued with good principles, *Plato* ‡ tells, that '*Jupiter*, to preſerve the 'race of men from periſhing, ſent *Mercury*, with orders to introduce 'modeſty and juſtice among them, as the firmeſt ties of human ſociety; 'and without which, it could not ſubſiſt.' And elſewhere, the ſame author gives it plainly as his ſenſe, that § 'concerning thoſe great duties

* Scientia Sin. Lib. I. Fol. 12.

† Men forget, that liberty conſiſts in a mean, or that there is any other extreme beſide tyranny. ‡ In Protagora. § De legibus, Lib. VIII.

'which

'which men's appetites and paſſions render difficult, it ſhould ſeem ra-
'ther the work of God to provide, than of human legiſlators, if it were
'poſſible to hope for a ſyſtem of laws framed and promulgated by God
'himſelf.' You ſee how agreeable the *Moſaic* and chriſtian inſtitutions are to the wiſhes of the wiſeſt heathen.

Moſes, indeed, doth not inſiſt on a future ſtate, the common baſis of all political inſtitutions. Nor do other lawgivers make a particular mention of all things neceſſary, but ſuppoſe ſome things as generally known or believed. The belief of a future ſtate, (which it is manifeſt the *Jews* were poſſeſſed of, long before the coming of CHRIST) ſeems to have obtained among the *Hebrews* from primæval tradition; which might render it unneceſſary for *Moſes* to inſiſt on that article. But the *Sadducees* and *Epicureans* had, in progreſs of time, gone ſo far towards rooting out this ancient and original ſentiment, that it was in danger of being loſt, had it not been taught and promulgated in a new light by our bleſſed Saviour.

But many among us, who would paſs for aſſertors of truth and liberty, are accuſtomed to rail at this, and all other eſtabliſhed opinions, as prejudices which people are taught whether they will or no, and before they are able to diſtinguiſh whether they are right or wrong. Theſe lovers of truth would do well to conſider, that in political, moral, and religious matters, the opinions of the vulgar, whether they go in coaches, or walk on foot, are for the moſt part prejudices; and are ſo like to be whatever ſide of the queſtion they embrace; whether they follow the old maxims of the religion of their country, or the modern inſtructions of their new maſters. I have already obſerved, that a point's being uſeful, and inculcated betimes, can be no argument of its falſhood, even although it ſhould be a prejudice; far otherwiſe, utility and truth are not to be divided; the general good of mankind, being the rule or meaſure of moral truth. *

* See ALCIPHRON, Dial. I. Sect. 16.

I ſhall

I ſhall now add, that it is to be apprehended, many of thoſe who are the moſt forward to baniſh prejudices, would be the firſt to feel the want of them. It is even pitiful to think what would become of certain modern declaimers on that article, were prejudice really ſet aſide, and were all men to be weighed in the exact ſcale of merit, and conſidered in proportion only to their intrinſic worth. Some prejudices are grounded in truth, reaſon and nature. Such are the reſpects which are paid to knowledge, learning, age, honeſty and courage, in all civilized countries. Others are purely the effect of particular conſtitutions; ſuch are the reſpects, rights and pre-eminences aſcribed to ſome men by their fellow-ſubjects, on account of their birth and quality; which, in the great empires of *Turkey* and *China*, paſs for nothing; and will paſs for nothing elſewhere, as ſoon as men have got rid of their prejudices, and learned to deſpiſe the conſtitutions of their country. It may behove thoſe who are concerned, to reflect on this betimes.

God, comprehending within himſelf, the beginning, end, and middle of all things and times, exerts his energy throughout the whole creation. He never ceaſeth to influence by inſtinct, by the light of nature, by his declared will. And it is the duty of magiſtrates and lawgivers, to cultivate and encourage thoſe divine impreſſions in the minds of all men under their care. We are not to think, it is the work of God, and therefore not to be ſeconded by human care. Far otherwiſe, for that very reaſon it claims our utmoſt care and diligence, it being the indiſpenſible duty of all good men, throughout the whole courſe of their lives, to cooperate with the deſigns of Providence. In religion, as in nature, God doth ſomewhat, and ſomewhat is to be done on the part of man. He cauſes the earth to bring forth materials for food and raiment; but human induſtry muſt improve, prepare, and properly apply both the one and the other, or mankind may periſh with cold and hunger. And according

cording to this ſame analogy,*, the principles of piety and religion, the things that belong to our ſalvation, although originally and primarily the work of God, yet require the protection of human government, as well as the furtherance and aid of all wiſe and good men.

And if religion in all governments be neceſſary, yet it ſeems to be ſo more eſpecially in monarchies: foraſmuch as the frugal manners, and more equal fortunes in republics, do not ſo much inflame men's appetites, or afford ſuch power or temptation to miſchief, as the high eſtate and great wealth of nobles under a king. Therefore, although the magiſtrate, (as was already obſerved) hath for his peculiar object, the temporal well-being of the State; yet this will by no means exempt him from a due concern for the religion of his country.

What was the ſenſe of our anceſtors on this point, appears throughout the whole conſtitution of theſe kingdoms; and in order to juſtify this conſtitution, and the wiſdom of thoſe who framed it, I ſhall crave leave to make uſe of ſome unſuſpected teſtimonies, ancient and modern, which will ſhew, that the public care of a national religion, hath been always a moſt principal point in the eſteem of wiſe men, however run down by the prevailing licence of our times.

The firſt teſtimony I ſhall produce, is that of *Zaleucus*, the famous law-giver of the *Locrians*; who, in his preamble to his laws,† begins with religion, laying it down as the corner ſtone, or foundation of his whole ſuperſtructure, 'That every inhabitant ſubject of the ſtate, ſhould be per-'ſuaded that there is a God and divine Providence: that the only way

* It will be ſufficient, if ſuch analogy appears between the diſpenſations of grace and nature, as may make it probable to ſuppoſe them derived from the ſame author. ALCIPHRON, Dial. VI. Sect 31.

† STOBÆUS de leg. & conſuet. Ser. 145.

'of becoming dear to God, is by endeavouring above all things, to be 'good, both in deed and in will: that a worthy citizen is one that pre-'fers integrity to wealth.' He further admoniſhes thoſe who are difficult to perſuade, 'To bethink themſelves of God's providence, and the 'puniſhments that await evil-doers; and in all their actions, to be ever 'mindful of the laſt day, as if it were preſent, or in caſe the * devil 'ſhould tempt a man to ſin, he exhorts ſuch a one to frequent the tem-'ples and altars, worſhipping and imploring the divine aſſiſtance.'

Ariſtotle, † diſcourſing of the means to preſerve a monarchy, admoniſhes the ſupreme magiſtrate, above all things to ſhew himſelf zealous in religious matters; and this particularly, for two reaſons. '1. Becauſe 'the ſubjects will have leſs to fear from one who fears God. 2. Becauſe 'they will be leſs apt to rebel againſt him, whom they take to be the fa-'vourite of heaven.' And elſewhere, this ſame philoſopher, recommends the worſhip of the Gods, as the firſt care of the ſtate. §

Plato likewiſe begins his laws with the care of religious rites. He even maintains religion, or divine worſhip, to be the chief aim and ſcope of human life. ‡

Hippodamus the *Mileſian*, ‖ in his ſcheme of a republic, allotted a third part of the land for maintaining divine worſhip. ¶

The *Roman* hiſtorians and poets do ſo abound with paſſages aſcribing the ſucceſſes of their government to religion, and its declenſion to the

* δαίμων κακὸς. † De Republ. Lib. V. § Ibid. Lib. VII. Cap. 17.
‡ De leg. Lib. IV. & Lib. VI. ‖ ARIST. de Republ. Lib. II. Cap. 8.
¶ The aboliſhing of the chriſtian religion, upon a frugal principle, muſt be bad policy, if we may judge what will be, by what hath been in the great Pagan ſtates of antiquity, whoſe religions, upon a fair eſtimate, will be found to have been more expenſive.

want

want or neglect thereof, that it may ſeem impertinent to enter into a detail of what every ſchool-boy knows.

To come from ancient, to modern authority, *Machiavel* himſelf, repreſents religion as abſolutely neceſſary to maintain civil order and government. He obſerves, that for many years, there was a moſt awful ſenſe of religion in the old *Romans*; and that this did much facilitate their great undertakings. He likewiſe obſerves, and ſhews by divers inſtances, that the *Romans* were more afraid to break an oath, than to trangreſs the laws; and that thoſe things which even the love of their country and conſtitution could not bring them to, they were brought to through a ſenſe of religion. Upon the whole, he concludes, that old *Rome* was more obliged to *Numa*, who eſtabliſhed a national religion, than to *Romulus* himſelf, the founder of that ſtate. *

And here by the by, I ſhall take notice, that ſome may imagine, the various forms and inſtitutions of religion ought to unſettle men's minds, with regard to the truth and certainty of any. But this matter rightly conſidered, will, I think, produce a contrary effect. It ſheweth, indeed, that men groping out their way by the dim twilight of nature did only approach, ſome nearer, ſome farther off, while all were ſhort of the truth. But then it ſheweth likewiſe, upon the whole, and in general, that religion is ſo natural to our minds, ſo uſeful to ſociety, and of ſo neceſſary importance to the world, as might well prove its truth, and render it worthy of the divine care to propagate by prophecies, miracles, and the miſſion of the Son of God.

Philip de Comines, † a wiſe ſtateſman, and honeſt writer, who had great experience in affairs, declares it to be his opinion, 'That want of religious faith, is the only fountain of all miſchiefs.'

* Discorsi, Lib. I. Cap. 12. † Hiſt. B. 5.

And that able miniſter, the famous Monſieur *Colbert*, * makes it his obſervation, 'That if once the eccleſiaſtical character, as ſuch, is vilified, 'the civil magiſtrate, even the crown itſelf, will, in conſequence thereof, 'loſe all authority.'

It would be no hard matter, to produce a cloud of teſtimonies in behalf of a national religion, from the moſt eminent of our own writers; but I ſhall content myſelf with adding one only, and that from a very unſuſpected writer, Mr. *Harrington*, author of the *Oceana*, who ſhews, that to be juſt and fair, which others have ſhewed to be expedient. '† A man (ſaith he) that pleading for liberty of conſcience, refuſeth liberty 'to the national conſcience, muſt be moſt abſurd. *And again:* if the 'conviction of a man's private conſcience, produce his private religion; 'the conviction of the national conſcience, muſt produce a national re-'ligion.' ‡

All theſe authorities are taken from thinking men, and able politicians, none of which can be ſuppoſed to ſay what he did not really think; and it had been very eaſy to have increaſed the number. But, I am ſorry, I was obliged to mention any at all, in proof of ſo plain and fundamental a point as that of a national religion. It is indeed, a ſhameful neceſſity we lie under, of proving at this time of day the firſt elements, I will not ſay of chriſtianity, but even of natural light, from reaſons and from authorities. The ſpirit of the times hath rendered this unavoidable.

If it ſhould be aſked after all, how comes it then to paſs, that the faſhionable and prevailing maxims among our betters, in a neighbouring nation, ſhould run directly counter to all ſuch reaſons and authorities? I will anſwer this queſtion, by aſking when were our neighbours known to abound to that degree in highwaymen, murderers, houſe-breakers, in-

* Teſt. Pol. C. 8. † P. 27. Firſt Edit. ‡ Ibid.

cendiaries?

cendiaries? When did ſuch numbers lay violent hands on themſelves? When was there ſuch a general and indecent contempt of whatever is eſteemed ſacred, in the ſtate as well as the church? When were there known among them ſuch public frauds, ſuch open confederacies in villainy, as the preſent age hath produced? When were they lower in the eſteem of mankind, more divided at home, or more inſulted abroad?

We of this land have a fatal tendency to overlook the good qualities, and imitate whatever is amiſs in thoſe whom we reſpect. This leads me to make ſome remarks on the modern ſpirit of reformation, that works ſo ſtrongly in both theſe kingdoms.

Freedom of thought is the general plea and cry of the age; and we all grant, that thinking is the way to know; and the more real knowledge there is in the land, the more likely it will be to thrive. We are not therefore againſt freedom of thought, but we are againſt thoſe unthinking, overbearing people,* who, in theſe odd times, under that pretence, ſet up for reformers, and new molders of the conſtitution. We declare againſt thoſe, who would ſeduce ignorant and unexperienced perſons from the reverence they owe to the laws and religion of their country; and under the notion of extirpating prejudices, would eraſe from their minds all impreſſions of piety and virtue, in order to introduce prejudices of another kind, deſtructive of ſociety.

We eſteem it a horrible thing, to laugh at the apprehenſions of a future ſtate, with the author of the *Characteriſtics* †; or with him who wrote the *Fable of the Bees*, to maintain that *moral virtues are the political off-*

* It is not reaſon candidly propoſed that offends, but the reviling, inſulting, ridiculing of the national laws and religion, all this profiteth for free-thinking, and muſt needs be offenſive to all reaſonable men.

† Vol. III. Miſcel. III. C. 2.

ſpring

ſpring which flattery begot upon pride *; that *in morals there is no greater certainty, than in faſhions of dreſs* †; *that*, indeed, *the doctrine of good manners teacheth men to ſpeak well of all virtues; but requires no more of them in any age or country, than the outward appearance of thoſe in faſhion.* ‡ Two authors of infidel ſyſtems theſe, who ſetting out upon oppoſite principles, are calculated to draw all mankind, by flattering either their vanity or their paſſions, into one or other ſyſtem. And yet, the people among whom ſuch books are publiſhed, wonder how it comes to paſs, that the civil magiſtrate daily loſeth his authority, that the laws are trampled upon, and the ſubject in conſtant fear of being robbed, or murdered, or having his houſe burnt over his head?

It may be preſumed, that the ſcience of finding fault, which above all others is eaſieſt to learn, ſuits beſt with a modern education. Too many there are of better fortunes than underſtandings, who have made the inquiry after truth, a very ſmall part of their care: theſe ſee ſomewhat, but not enough. It were to be wiſhed, they knew either leſs or more. One thing it is evident they do not know; to wit, that while they rail at prejudice, they are undoing themſelves: they do not comprehend, (what hath been before hinted) that their whole figure, their political exiſtence, is owing to certain vulgar prejudices, in favour of birth, title, or fortune, which add nothing of real worth either to mind or body; and yet, cauſe the moſt worthleſs perſon to be reſpected.

Freedom of thought is the prerogative of human kind; it is a quality inherent in the very nature of a thinking being. Nothing is more evident, than that every one can think his own way, in ſpite of any outward force or power whatſoever. It is therefore ridiculous for any man

* Inquiry into the Origin of moral Virtue. Ed. 6. P. 37.

† The author's remarks on his Fable of the Bees, P. 379.

‡ Remarks, Part II. P. 155.

to

to declaim in defence of a privilege, which cannot be denied or taken from him. But this will not infer a boundleſs freedom of ſpeech, * an open contempt of laws, and a preſcribing from private judgment † againſt public authority, things never borne in any well-ordered ſtate; and which make the crying diſtemper of our times.

I am ſenſible, that whatever looks like a reſtraint on freedom of inquiry, muſt be very diſagreeable to all reaſoning and inquiſitive men. But againſt this, I have ſaid nothing. § On the contrary, I will freely own, a judicious and impartial ſearch after truth, is the moſt valuable employment of the mind. Thoſe who have the talents, and will be at the pains, cannot do better than engage in that noble purſuit. But thoſe who are not qualified by age or education; thoſe who have neither diſpoſition, nor leiſure, nor faculties to dig in the mine of truth themſelves, muſt take it as retailed out by others. I ſee no remedy. GOD who knows the opportunities of every man, requires impoſſibilities from no man. And where there is a ſincere love of truth and virtue, the grace of GOD can eaſily ſupply the defect of human means.

It hath been before obſerved, and ſhewed at large, that the bulk of mankind muſt have their minds betimes imbued with good and wholeſome notions or principles, by their parents, paſtors, and tutors, or elſe bad notions, hurtful to themſelves and others, will undoubtedly take poſſeſſion thereof. Such bad notions have, for ſeveral years paſt, been propagated with uncommon induſtry in theſe kingdoms: they now bring

* Is there no difference between indulging ſcrupulous conſciences, and tolerating public deriders of all conſcience and religion?

† A man who is himſelf permitted to follow his own private judgment, cannot well complain, although he may not ſet it up as a public rule.

§ The profane and lawleſs ſcorner is one thing, and the modeſt inquirer after truth another.

forth

forth fruit every day more and more abundant. It is to be feared, that what hath been long ripening, is now near ripe. Many are the ſigns and tokens. He that runs, may read.

But there cannot be a higher, or more flagrant ſymptom of the madneſs of our times, than that execrable fraternity of blaſphemers, lately ſet up within this city of *Dublin*. Blaſphemy againſt God, is a great crime againſt the ſtate. But that a ſet of men ſhould, in open contempt of the laws, make this very crime their profeſſion, diſtinguiſh themſelves by a peculiar name,* and form a diſtinct ſociety, whereof the proper and avowed buſineſs ſhall be, to ſhock all ſerious chriſtians by the moſt impious and horrid blaſphemies, uttered in the moſt public manner: this ſurely muſt alarm all thinking men. It is a new thing under the ſun reſerved for our worthy times and country.

It is no common blaſphemy I ſpeak of: it is not ſimple curſing and ſwearing: it is not the effect either of habit or ſurpriſe; but a train of ſtudied deliberate indignities againſt the divine Majeſty; and thoſe, of ſo black and helliſh a kind, as the tongues alone which uttered them, can duly characterize and expreſs. This is no ſpeculative hereſy, no remote or doubtful inference from an author's tenets. It is a direct and open attack on God himſelf. It is ſuch a calm premeditated inſult upon religion, law, and the very light of nature, that there is no ſect or nation of men, whether Chriſtians, Jews, Mahometans, or even civilized heathens, that would not be ſtruck with horror and amazement at the thought of it, and that would not animadvert † on its authors with the utmoſt ſeverity.

* Blaſters.

† They (if there be any ſuch) who think to ſerve the Reformation, by joining with blaſters and devil-worſhippers in a plea for licence, are in truth a ſcandal and reproach to the Proteſtant cauſe.

Deliberate.

Deliberate, atheiſtical blaſphemy, is of all crimes moſt dangerous to the public, inaſmuch as it opens the door to all other crimes, and virtually contains them all. A religious awe and fear of GOD, being (as we have already obſerved) the centre that unites, and the cement that connects all human ſociety. He, who makes it his buſineſs, to leſſen or root out from the minds of men this principle, doth in effect, endeavour to fill his country with highwaymen, houſe-breakers, murderers, fraudulent dealers, perjured witneſſes, and every other peſt of ſociety. Therefore, it would be the greateſt cruelty to our children, neighbours, and country, to connive at ſuch a crime; a crime! which hath no natural paſſion or temptation to plead for it, but is the pure effect of an abandoned impudence in wickedneſs; and, perhaps, of a miſtaken hope, that the laws and magiſtrates are aſleep.

The queſtion is not now, whether religion ſhall be eſtabliſhed by law: the thing is already done, (and done with good reaſon, as appeareth from the premiſſes) but whether a reverence * for the laws ſhall be preſerved. Religion, conſidered as a ſyſtem of ſaving truths, hath its ſanction from heaven; its rewards and penalties are divine. But religion, as uſeful and neceſſary to ſociety, hath been wiſely eſtabliſhed by law; and ſo eſtabliſhed, and wrought into the very frame and principles of our government, is become a main part of the civil conſtitution. Our laws, are the laws of a chriſtian country: our government hath been conſtituted and modelled by chriſtians; and is ſtill adminiſtered and maintained by men profeſſing belief in CHRIST. Can it then be ſuppoſed, that impious men ſhall with impunity, invent and † publicly utter the moſt horrid

* They who plead a right to contradict the laws, can pretend none for doing it with inſolence or diſreſpect.

† To make the cauſe of ſuch men the cauſe of liberty or toleration, would be monſtrous. A man is not ſuffered publicly to blaſpheme, therefore he may not think freely: a profane miſcreant is not indulged in the public worſhip of the devil, therefore a conſcientious perſon may not ſerve God his own way: is not this abſurd?

blaſphemies; and at the ſame time, the whole conſtitution not be endangered? Or can it be ſuppoſed that magiſtrates, or men inveſted with power, ſhould look on, and ſee the moſt ſacred part of our conſtitution trampled under foot, and yet imagine their own dignity and authority to be ſecure, which reſt intirely thereupon? I will venture to ſay, that whoever is a wiſe man, and a lover of his country, will not only be ſolicitous to preſerve the honour of GOD ſacred and intire; he will even diſcourage that prevailing prejudice againſt the diſpenſers of GOD's word, the teachers of thoſe ſalutary doctrines, without which the public cannot thrive or ſubſiſt. He will be no contemner, not even of thoſe rites and ordinances enjoined by law, as neceſſary to imprint and retain a ſenſe of religion in the minds of men. He will extend his care to the outworks, as knowing that when theſe are gone, it may be difficult to preſerve the reſt.

Notwithſtanding the vain aſſertion of thoſe men, who would juſtify the preſent, by ſaying *all times are alike*, it is moſt evident, that the magiſtrates, the laws, the very conſtitution of theſe realms, have loſt no ſmall ſhare of their authority and reverence, ſince this great growth and ſpreading of impious principles. Whatever be the cauſe, the effect is apparent. Whether we aſcribe it to the natural courſe of things, or to a juſt judgment upon thoſe, who, having been careleſs to preſerve a due ſenſe of the divine authority, have ſeen and ſhall ſee their own deſpiſed.

Darius, a heathen prince, made a decree, that in every dominion of his kingdom, men ſhould tremble and fear before GOD. * *Nebuchadnezzar* likewiſe, another heathen, made a decree, that every people, nation, and language which ſpoke any thing amiſs againſt GOD ſhould be cut in pieces, and their houſes made a dunghill. † And if theſe things were done in *Perſia* and *Babylon*, ſurely it may be expected, that impious blaſphemers againſt GOD, and his worſhip, ſhould, at leaſt, be diſcouraged and put out

* DAN. ch. vi. ver. 26. † DAN. ch. iii. ver. 29.

of

of countenance in theſe chriſtian countries. Now, a conſtant courſe of diſfavour from men in authority, would prove a moſt effectual check to all ſuch miſcreants. When therefore they are public and bold in their blaſphemies, this is no ſmall reflection on thoſe who might check them if they would.

It is not ſo much the execution of the laws, as the countenance of thoſe in authority, that is wanting to the maintenance of religion. If men of rank and power, who have a ſhare in diſtributing juſtice, and a voice in the public councils, ſhall be obſerved to neglect divine worſhip themſelves, it muſt needs be a great temptation for others to do the ſame. But if they, and their families, ſhould ſet a good example, it may be preſumed, that men of leſs figure would be diſpoſed to follow it. Faſhions are always obſerved to deſcend, and people are generally fond of being in the faſhion; whence one would be apt to ſuſpect, the prevailing contempt of GOD's word, and eſtrangement from his houſe, to a degree that was never known in any chriſtian country, muſt take its riſe from the irreligion and bad example of thoſe who are ſtyled *the better ſort.*

Offences muſt come, but woe be to him, by whom the offence cometh. A man who is entruſted with power and influence in his country, hath much to anſwer for, if religion and virtue ſuffer through want of his authority and countenance. But in caſe he ſhould, by the vanity of his diſcourſe, his favour to wicked men, or his own apparent neglect of all religious duties, countenance what he ought to condemn, and authoriſe by his own example what he ought to puniſh; ſuch a one, whatever he may pretend, is in fact a bad patriot, a bad citizen, and a bad ſubject, as well as a bad chriſtian.

Our proſpect is very terrible, and the ſymptoms grow ſtronger every day. The morals of a people are in this, like their fortunes; when they

feel a national ſhock, the worſt doth not ſhew itſelf immediately. Things make a ſhift to ſubſiſt for a time, on the credit of old notions and dying opinions. But the youth born and brought up in wicked times, without any bias to good from early principle, or inſtilled opinion, when they grow ripe muſt be monſters indeed. And it is to be feared, that age of monſters is not far off.

Whence this impiety ſprings, by what means it gains ground among us, and how it may be remedied, are matters that deſerve the attention of all thoſe who have the power and the will to ſerve their country. And although many things look like a prelude to general ruin; although it is much to be apprehended, we ſhall be worſe before we are better; yet who knows what may enſue, if all perſons in power, from the ſupreme executor of the law, down to a petty conſtable, would, in their ſeveral ſtations, behave themſelves like men, truly conſcious and mindful, that the authority they are clothed with, is but a ray derived from the ſupreme authority of heaven? This may not a little contribute to ſtem that torrent, which from ſmall beginnings, and under ſpecious pretences, hath grown to ſuch a head, and daily gathers force more and more to that degree, as threatens a general inundation and deſtruction of theſe realms.

A

WORD TO THE WISE:

OR, AN

EXHORTATION

TO THE

ROMAN CATHOLIC CLERGY of *IRELAND*.

A

WORD TO THE WISE.

BE not ſtartled, *Reverend Sirs*, to find yourſelves addreſſed to by one of a different communion. We are indeed (to our ſhame be it ſpoken) more inclined to hate for thoſe articles wherein we differ, than to love one another for thoſe wherein we agree. But if we cannot extinguiſh, let us at leaſt ſuſpend our animoſities, and forgetting our religious feuds, conſider ourſelves in the amiable light of countrymen and neighbours. Let us for once turn our eyes on thoſe things, in which we have one common intereſt. Why ſhould diſputes about faith interrupt the duties of civil life? or the different roads we take to heaven prevent our taking the ſame ſteps on earth? Do we not inhabit the ſame ſpot of ground, breathe the ſame air, and live under the ſame government? Why then ſhould we not conſpire in one and the ſame deſign, to promote the common good of our country?

We are all agreed about the uſefulneſs of meat, drink, and clothes, and without doubt, we all ſincerely wiſh our poor neighbours were better ſupplied with them. Providence and nature have done their part; no country is better qualified to furniſh the neceſſaries of life, and yet no people are worſe provided. In vain is the earth fertile, and the climate benign, if human labour be wanting. Nature ſupplies the materials, which art and induſtry improve to the uſe of man, and it is the want of this induſtry that occaſions all our other wants.

The

The public hath endeavoured to excite and encourage this moſt uſeful virtue. Much hath been done; but whether it be from the heavineſs of the climate, or from the *Spaniſh*, or *Scythian* blood that runs in their veins, or whatever elſe may be the cauſe, there ſtill remains in the natives of this iſland a remarkable antipathy to labour. You, *Gentlemen*, can alone conquer their innate hereditary ſloth. Do you then, as you love your country, exert yourſelves.

You are known to have great influence on the minds of your people, be ſo good as to uſe this influence for their benefit. Since other methods fail, try what *you* can do. *Be inſtant in ſeaſon, out of ſeaſon, reprove, rebuke, exhort.* * Make them thoroughly ſenſible of the ſin and folly of ſloth. Shew your charity in clothing the naked and feeding the hungry, which you may do by the mere breath of your mouths. Give me leave to tell you, that no ſet of men upon earth have it in their power to do good on eaſier terms, with more advantage to others, and leſs pains or loſs to themſelves. Your flocks are of all others, moſt diſpoſed to follow directions, and of all others want them moſt; and indeed what do they not want?

The houſe of an *Iriſh Peaſant* is the cave of poverty; within, you ſee a pot and a little ſtraw; without, a heap of children tumbling on the dunghill. Their fields and gardens are a lively counterpart of *Solomon*'s deſcription in the proverbs; *I went*, ſaith that wiſe king, *by the field of the ſlothful, and by the vineyard of the man void of underſtanding, and lo! it was all grown over with thorns, and nettles had covered the face thereof, and the ſtone wall thereof was broken down.* † In every road the ragged enſigns of poverty are diſplayed; you often meet caravans of poor, whole families in a drove, without clothes to cover, or bread to feed them, both which might be eaſily procured by moderate labour. They are encou-

* 2 Tim. ch. iv. ver. 2. † Prov. ch. xxiv. ver. 30, 31.

raged

raged in this vagabond life by the miſerable hoſpitality they meet with in every cottage, whoſe inhabitants expect the ſame kind reception in their turn, when they become beggars themſelves; beggary being the laſt refuge of theſe improvident creatures.

If I ſeem to go out of my province, or to preſcribe to thoſe who muſt be ſuppoſed to know their own buſineſs, or to paint the lower inhabitants of this land in no very pleaſing colours, you will candidly forgive a well meant zeal, which obligeth me to ſay things, rather uſeful than agreeable, and to lay open the ſore in order to heal it.

But whatever is ſaid muſt be ſo taken, as not to reflect on perſons of rank and education, who are no way inferior to their neighbours; nor yet to include all even of the loweſt ſort, though it may well extend to the generality, of thoſe eſpecially in the weſtern and ſouthern parts of the kingdom, where the *Britiſh* manners have leſs prevailed. We take our notions from what we ſee, mine are a faithful tranſcript from originals about me.

The *Scythians* were noted for wandering, and the *Spaniards* for ſloth and pride; our *Iriſh* are behind neither of theſe nations from which they deſcend, in their reſpective characteriſtics. *Better is he that laboureth and aboundeth in all things, than he that boaſteth himſelf and wanteth bread*, ſaith the *Son* of *Sirach* *, but ſo ſaith not the *Iriſhman*. In my own family a kitchen-wench refuſed to carry out cinders, becauſe ſhe was deſcended from an old *Iriſh ſtock* Never was there a more monſtrous conjunction than that of pride with beggary; and yet this prodigy is ſeen every day in almoſt every part of this kingdom. At the ſame time theſe proud people are more deſtitute than *ſavages*, and more abject than *negroes*. The *negroes* in our plantations have a ſaying, *If negro was not negro*,

* Ch. x. ver. 27.

Iriſhman would be Negro. And it may be affirmed with truth, that the very *ſavages* of *America* are better clad and better lodged than the *Iriſh cottagers* throughout the fine fertile counties of *Limerick* and *Tipperary.*

Having long obſerved and bewailed this wretched ſtate of my countrymen, and the inſufficiency of ſeveral methods ſet on foot to reclaim them, I have recourſe to *your Reverences*, as the *dernier reſort.* Make them to underſtand that you have their intereſt at heart, that you perſuade them to work for their own ſakes, and that GOD hath ordered matters ſo as that, they who will not work for themſelves, muſt work for others. The terrors of debt, ſlavery, and famine ſhould, one would think, drive the moſt ſlothful to labour. Make them ſenſible of theſe things, and that the ends of Providence and order of the world require induſtry in human creatures. *Man goeth forth to his work, and to his labour until the evening*, ſaith the *Pſalmiſt*, when he is deſcribing the beauty, order and perfection of the works of GOD. * But what ſaith the ſlothful perſon? *yet a little ſleep, a little ſlumber, a little folding of the hands to ſleep.* † But what ſaith the wiſe man? *ſo ſhall thy poverty come as one that travelleth, and thy want as an armed man.* ‡

All nature will furniſh you with arguments and examples againſt ſloth, *go to the ant thou ſluggard*, cries *Solomon.* The ant, the bee, the beetle, and every inſect but the drone reads a leſſon of induſtry to man. But the ſhorteſt and moſt effectual leſſon is that of St. *Paul, if any man will not work neither ſhould he eat.* § This command was enjoined the *Theſſalonians*, and equally reſpects all *Chriſtians*, and indeed all *mankind*; it being evident by the light of nature, that the whole creation works together for good, and that no part was deſigned to be uſeleſs; as therefore the *idle man* is of no uſe, it follows that he hath no right to a ſubſiſtence.

* Pſ. civ. ver. 23. † Prov. ch. vi. ver. 10.
‡ Prov. ch. vi. ver. 11. § 2 Theſſ. ch. iii. ver. 10.

Let

Let them work, ſaith the *Apoſtle*, *and eat their own bread*; * not bread got by begging, not bread earned by the ſweat of other men; but their own bread, that which is got by their own labour. *Then ſhalt thou eat the labour of thine hands*, ſaith the *Pſalmiſt*, to which he adds, *happy ſhalt thou be and it ſhall be well with thee*; † intimating, that to work and enjoy the fruits thereof is a great bleſſing.

A ſlothful man's imagination is apt to dreſs up labour in a horrible maſk; but, horrible as it is, idleneſs is more to be dreaded, and a life of poverty (its neceſſary conſequence) is far more painful. It was the advice of *Pythagoras*, *to chuſe the beſt kind of life*, for that uſe would render it agreeable, reconciling men even to the rougheſt exerciſe. By practice, pains become at firſt eaſy, and in the progreſs pleaſant; and this is ſo true, that whoever examines things will find, there can be no ſuch thing as a happy life without labour, and that whoever doth not labour with his hands, muſt in his own defence labour with his brains.

Certainly, planting and tilling the earth is an exerciſe not leſs pleaſing than uſeful; it takes the peaſant from his ſmoaky cabin into the freſh air and the open field, rendering his lot far more deſirable than that of the ſluggard, who lies in the ſtraw, or ſits whole days by the fire.

Convince your people that not only pleaſure invites, but neceſſity alſo drives them to labour. If you have any compaſſion for theſe poor creatures, put them in mind how many of them periſhed in a late memorable diſtreſs, through want of that provident care againſt a hard ſeaſon, obſervable not only in all other men, but even in irrational animals. Set before their eyes in lively colours, their own indigent and ſordid lives, compared with thoſe of other people, whoſe induſtry hath procured them hearty food, warm clothes, and decent dwellings. Make them ſenſible

* 2 Theſſ. ch. iii. ver. 12. † Pſ. cxxviii. ver. 2.

what a reproach it is, that a nation which makes ſo great pretenſions to antiquity, and is ſaid to have flouriſhed many ages ago in arts and learning, ſhould in theſe our days turn out a lazy, deſtitute, and degenerate race.

Raiſe your voices, *Reverend Sirs*, exert your influence, ſhew your authority over the multitude, by engaging them to the practice of an honeſt induſtry, a duty neceſſary to all, and required in all, whether *Proteſtants*, or *Roman Catholics*, whether *Chriſtians*, *Jews*, or *Pagans*. Be ſo good among other points to find room for *this*, than which none is of more concern to the ſouls and bodies of your hearers, nor conſequently deſerves to be more amply, or frequently inſiſted on.

Many and obvious are the motives that recommend this duty. Upon a ſubject ſo copious you can never be at a loſs for ſomething to ſay. And while by theſe means you reſcue your countrymen from want and miſery, you will have the ſatisfaction to behold your country itſelf improved. What pleaſure muſt it give you to ſee theſe waſte and wild ſcenes, theſe naked ditches, and miſerable hovels, exchanged for fine plantations, rich meadows, well-tilled fields, and neat dwellings; to ſee people well fed, and well clad, inſtead of famiſhed, ragged ſcarecrows; and thoſe very perſons tilling the fields that uſed to beg in the ſtreets.

Neither ought the difficulty of the enterpriſe to frighten you from attempting it. It muſt be confeſſed a habit of induſtry is not at once introduced; neighbour, nevertheleſs, will emulate neighbour, and the contagion of good example will ſpread as ſurely as of bad, though perhaps not ſo ſpeedily. It may be hoped, there are many that would be allured by a plentiful and decent manner of life to take pains, eſpecially when they obſerve it to be attained by the induſtry of their neighbours, in no ſort better qualified than themſelves.

If

If the ſame gentle ſpirit of ſloth did not ſooth our ſquires as well as peaſants, one would imagine there ſhould be no idle hands among us. Alas! how many incentives to induſtry offer themſelves in this iſland, crying aloud to the inhabitants for work? Roads to be repaired, rivers made navigable, fiſheries on the coaſts, mines to be wrought, plantations to be raiſed, manufactures improved, and, above all, lands to be till ed and ſowed with all ſorts of grain.

When ſo many circumſtances provoke and animate your people to labour, when their private wants, and the neceſſities of the public, when the laws, the magiſtrates, and the very country calls upon them, you cannot think it becomes you alone to be ſilent, or hindmoſt in every project for promoting the public good. Why ſhould you, whoſe influence is greateſt, be leaſt active? why ſhould you, whoſe words are moſt likely to prevail, ſay leaſt in the common cauſe?

Perhaps it will be ſaid, the diſcouragements attending thoſe of your communion are a bar againſt all endeavours for exciting them to a laudable induſtry. Men are ſtirred up to labour by the proſpect of bettering their fortunes, by getting eſtates, or employments; but thoſe who are limited in the purchaſe of eſtates, and excluded from all civil employments, are deprived of thoſe ſpurs to induſtry.

To this it may be anſwered, that admitting theſe conſiderations do, in ſome meaſure, damp induſtry and ambition in perſons of a certain rank, yet they can be no let to the induſtry of poor people, or ſupply an argument againſt endeavouring to procure meat, drink, and clothes. It is not propoſed, that you ſhould perſuade the better ſort to acquire eſtates, or qualify themſelves for becoming magiſtrates; but only that you ſhould ſet the loweſt of the people at work, to provide themſelves with neceſſaries, and ſupply the wants of nature.

It will be alleged in excuſe of their idleneſs, that the country people want encouragement to labour, as not having a property in the lands. There is ſmall encouragement, ſay you, for them to build, or plant upon another's land, wherein they have only a temporary intereſt. To which I anſwer, that life itſelf is but temporary; that all tenures are not of the ſame kind; that the caſe of our *Engliſh* and the original *Iriſh* is equal in this reſpect; and that the true *Aborigines*, or natural *Iriſh* are noted for want of induſtry in improving even on their own lands, whereof they have both poſſeſſion and property.

How many induſtrious perſons are there in all civilized countries, without any property in lands, or any proſpect of eſtates, or employments? Induſtry never fails to reward her votaries. There is no one but can earn a little, and little added to little makes a heap. In this fertile and plentiful iſland, none can periſh for want but the idle and improvident. None who have induſtry, frugality, and foreſight but may get into tolerable, if not wealthy circumſtances. Are not all trades and manufactures open to thoſe of your communion? have you not the ſame free uſe, and may you not make the ſame advantage of fairs and markets as other men? do you pay higher duties, or are you liable to greater impoſitions than your fellow ſubjects? and are not the public premiums and encouragements given indifferently to artiſts of all communions? have not, in fact, thoſe of your communion a very great ſhare of the commerce of this kingdom in their hands? and is not more to be got by this than by purchaſing eſtates, or poſſeſſing civil employments, whoſe incomes are often attended with large expences?

A tight houſe, warm apparel, and wholeſome food are ſufficient motives to labour. If all had them, we ſhould be a flouriſhing nation. And if thoſe who take pains may have them, thoſe who will not take pains are not

not to be pitied; they are to be looked on and treated as drones, the peſt and diſgrace of ſociety.

It will be ſaid, the hardneſs of the landlord cramps the induſtry of the tenant. But if rent be high, and the landlord rigorous, there is more need of induſtry in the tenant. It is well known that in *Holland*, taxes are much higher, and rent both of land and houſes far dearer than in *Ireland*. But this is no objection or impediment to the induſtry of the people, who are rather animated and ſpurred on to earn a livelihood by labour, that is not to be got without it.

You will ſay, it is an eaſy matter to make a plauſible diſcourſe on induſtry, and its advantages; but what can be expected from poor creatures, who are deſtitute of all conveniencies for exerting their induſtry, who have nothing to improve upon, nothing to begin the world with? I anſwer they have their four quarters, and five ſenſes. Is it nothing to poſſeſs the bodily organs ſound and entire? That wonderful machine the hand, was it formed to be idle?

Was there but will to work, there are not wanting in this iſland either opportunities, or encouragements. Spinning alone might employ all idle hands (children as well as parents) being ſoon learned, eaſily performed, and never failing of a market, requiring neither wit nor ſtrength, but ſuited to all ages and capacities. The public provides utenſils, and perſons for teaching the uſe of them; but the public cannot provide a heart and will to be induſtrious. Theſe, I will not deny, may be found in ſeveral perſons in ſome other parts of the kingdom, and wherever they are found, the comfortable effects ſhew themſelves. But ſeldom, very ſeldom are they found in theſe ſouthern people, whoſe indolence figureth a lion in the way, and is proof againſt all encouragement.

But

But you will inſiſt, how can a poor man, whoſe daily labour goes for the payment of his rent, be able to provide preſent neceſſaries for his family, much leſs to lay up a ſtore for the future. It muſt be owned, a conſiderable ſhare of the poor man's time and labour goes towards paying his rent. But how are his wife and children employed, or how doth he employ himſelf the reſt of his time? The ſame work tires, but different works relieve. Where there is a true ſpirit of induſtry, there will never be wanting ſomething to do, without doors, or within, by candle-light, if not by day-light. *Labor ipſe voluptas*, ſaith the poet, and this is verified in fact.

In *England*, when the labour of the field is over, it is uſual for men to betake themſelves to ſome other labour of a different kind. In the northern parts of that induſtrious land, the inhabitants meet, a jolly crew, at one another's houſes, where they merrily and frugally paſs the long and dark winter evenings; ſeveral families by the ſame light, and the ſame fire, working at their different manufactures of wool, flax, or hemp; company mean while mutually cheering and provoking to labour. In certain other * parts you may ſee, on a ſummer's evening, the common labourers ſitting along the ſtreets of a town, or village, each at his own door, with a cuſhion before him making bone-lace, and earning more in an evening's paſtime than an *Iriſh family* would in a whole day. Thoſe people inſtead of cloſing the day with a game on greaſy cards, or lying ſtretched before the fire, paſs their time much more chearfully in ſome uſeful employment, which cuſtom hath rendered light and agreeable.

But admitting, for the various reaſons above alleged, that it is impoſſible for our cottagers to be rich, yet it is certain they may be clean. Now bring them to be cleanly, and your work is half done. A little waſhing, ſcrubbing, and rubbing, beſtowed on their perſons and houſes,

* e. g. *Newport Pagnel* in *Buckinghamſhire*.

would

would introduce a ſort of induſtry, and induſtry in any one kind is apt to beget it in another.

Indolence in dirt is a terrible ſymptom, which ſhews itſelf in our lower *Iriſh* more, perhaps, than in any people on this ſide the *Cape of Good Hope*. I will venture to add, that look throughout the kingdom, and you ſhall not find a clean houſe inhabited b cleany people, and yet wanting neceſſaries; the ſame ſpirit of induſtry that keeps folk clean, being ſufficient to keep them alſo in food and raiment.

But alas! our poor *Iriſh* are wedded to dirt upon principle. It is with ſome of them a maxim, that the way to make children thrive is to keep them dirty. And I do verily believe, that the familiarity with dirt, contracted and nouriſhed from their infancy, is one great cauſe of that ſloth which attends them in every ſtage of life. Were children but brought up in an abhorrence of dirt, and obliged to keep themſelves clean, they would have ſomething to do, whereas they now do nothing.

It is paſt all doubt, that thoſe who are educated in a ſupine neglect of all things, either profitable or decent, muſt needs contract a ſleepineſs and indolence, which doth neceſſarily lead to poverty, and every other diſtreſs that attends it. *Love not ſleep*, cries *Solomon*, *leſt thou come to poverty*; *open thine eyes and thou ſhalt be ſatisfied with bread.* * It is therefore greatly to be wiſhed, that you would perſuade parents, to inure their children betimes to a habit of induſtry, as the ſureſt way to ſhun the miſeries that muſt otherwiſe befal them.

An early habit, whether of ſloth, or diligence, will not fail to ſhew itſelf throughout the whole courſe of a man's life. *Train up a child*, ſaith the wiſe man, *in the way he ſhould go, and when he is old he will not depart*

* Prov. ch. xx. ver. 13.

from it. * The firſt tincture often leaves ſo deep a ſtain as no afterthought or endeavour can waſh out. Hence ſloth in ſome minds is proof againſt all arguments and examples whatſoever, all motives of intereſt and duty, all impreſſions even of cold and hunger. This habit rooted in the child, grows up and adheres to the man, producing a general liſtleſſneſs, and averſion from labour. This I take to be our great calamity.

For admitting, that ſome of our ſquires and landlords are vultures with irons bowels, and that their hardneſs and ſeverity is a great diſcouragement to the tenant, who will naturally prefer want and eaſe, before want and toil; it muſt at the ſame time be admitted, that neither is the landlord, generally ſpeaking, ſo hard, nor the climate ſo ſevere, nor the ſoil ſo ungrateful, as not to anſwer the huſbandman's labour, where there is a ſpirit of induſtry; the want of which is the true cauſe of our national diſtreſs. Of this there are many evident proofs.

I have myſelf known a man, from the loweſt condition of life, without friends or education, not knowing ſo much as to write or read, bred to no trade or calling, by pure dint of day-labour, frugality, and foreſight, to have grown wealthy, even in this iſland, and under all the abovementioned diſadvantages. And what is done by one, is poſſible to another.

In *Holland* a child five years old is maintained by its own labour; in *Ireland* many children of twice that age do nothing but ſteal, or encumber the hearth and dunghill. This ſhameful neglect of education ſhews itſelf through the whole courſe of their lives, in a matchleſs ſloth bred in the very bone, and not to be accounted for by any outward hardſhip or diſcouragement whatever. It is the native colour, if we may ſo ſpeak, and complexion of the people. *Dutch*, *Engliſh*, *French*, or *Flemiſh* cannot match them.

* Prov. ch. xxii. ver. 6.

Mark

Mark an *Iriſhman* at work in the field; if a coach, or horſeman go by, he is ſure to ſuſpend his labour, and ſtand ſtaring until they are out of ſight. A neighbour of mine made it his remark in a journey from *London* to *Briſtol*, that all the labourers, of whom he enquired the road, conſtantly anſwered without looking up, or interrupting their work, except one who ſtood ſtaring and leaning on his ſpade, and him he found to be an *Iriſhman*.

It is a ſhameful thing and peculiar to this nation, to ſee luſty vagabonds ſtrolling about the country, and begging without any pretence to beg. Aſk them why they do not labour to earn their own livelihood, they will tell you, They want employment; offer to employ them, and they ſhall refuſe your offer; or, if you get them to work one day, you may be ſure not to ſee them the next. I have known them decline even the lighteſt labour, that of hay-making, having at the ſame time neither clothes for their backs, nor food for their bellies.

A ſore leg is an eſtate to ſuch a fellow, and this may be eaſily got, and continued with ſmall trouble. Such is their lazineſs, that rather than work they will cheriſh a diſtemper. This I know to be true, having ſeen more than one inſtance, wherein the ſecond nature ſo far prevailed over the firſt, that ſloth was preferred to health. To theſe beggars who make much of their ſores, and prolong their diſeaſes, you cannot do a more thankleſs office than cure them, except it be to ſhave their beards, which conciliate a ſort of reverence to that order of men.

It is indeed a difficult taſk to reclaim ſuch fellows from their ſlothful and brutal manner of life, to which they ſeem wedded with an attachment that no temporal motives can conquer; nor is there, humanly ſpeaking, any hopes they will mend, except their reſpect for your leſſons, and fear of ſomething beyond the grave be able to work a change in them.

Certainly, if I may adviſe, you ſhould in return for the lenity and indulgence of the government, endeavour to make yourſelves uſeful to the public; and this will beſt be performed, by rouſing your poor countrymen from their beloved ſloth. I ſhall not now diſpute the truth, or importance of other points, but will venture to ſay, that you may ſtill find time to inculcate this doctrine of an *honeſt induſtry*, and that this would by no means be time thrown away, if promoting your country's intereſt, and reſcuing ſo many unhappy wretches of your communion from beggary, or the gallows, be thought worth your pains.

It ſhould ſeem you cannot in your ſermons do better than inveigh againſt idleneſs, that extenſive parent of many miſeries and many ſins; idleneſs the mother of hunger and ſiſter of theft; *Idleneſs which*, the *Son* of *Sirach* aſſures us, *teacheth many vices.*

The ſame doctrine is often preached from the gallows. And indeed the poverty, nakedneſs, and famine which idleneſs entaileth on her votaries, do make men ſo wretched, that they may well think it better to die than to live ſuch lives. Hence a courage for all villainous undertakings, which bringing men to a ſhameful death, do then open their eyes when they are going to be cloſed for ever.

If you have any regard (as it is not to be doubted) either for the ſouls, or bodies of your people, or even for your own intereſt and credit, you cannot fail to inveigh againſt this crying ſin of your country. Seeing you are obnoxious to the laws, ſhould you not in prudence try to reconcile yourſelves to the favour of the public; and can you do this more effectually, than by co-operating with the public ſpirit of the legiſlature, and men in power?

Were

Were this but done heartily, would you but *be inſtant in ſeaſon, and out of ſeaſon, reprove, rebuke, exhort,* * ſuch is the aſcendant you have gained over the people, that we might ſoon expect to ſee the good effects thereof. We might hope *that our garners would be ſoon full, affording all manner of ſtore, that our ſheep would bring forth thouſands, that our oxen would be ſtrong to labour, that there would be no breaking in, nor going out,* (no robbery, nor migration for bread) *and that there would be no complaining in our ſtreets.* †

It ſtands you upon to act with vigour in this cauſe, and ſhake off the ſhackles of ſloth from your countrymen, the rather, becauſe there be ſome who ſurmiſe, that yourſelves have put them on. Right, or wrong, men will be apt to judge of your doctrines by their fruits. It will reflect ſmall honour on their teachers, if inſtead of honeſty and induſtry thoſe of your communion are peculiarly diſtinguiſhed by the contrary qualities, or if the nation converted by the great and glorious St. *Patrick* ſhould, above all other nations, be ſtigmatized and marked out as good for nothing.

I can never ſuppoſe you ſo much your own enemies, as to be friends to this odious ſloth. But were this once aboliſhed, and a laudable induſtry introduced in its ſtead, it may perhaps be aſked, who are to be gainers? I anſwer, *your Reverences* are like to be great gainers; for every penny you now gain, you will gain a ſhilling: you would gain alſo in your credit: and your lives would be more comfortable.

You need not be told, how hard it is to rake from rags and penury a tolerable ſubſiſtence; or how offenſive to perform the duties of your function, amidſt ſtench and naſtineſs; or how much things would change for the better, in proportion to the induſtry and wealth of your flocks. Duty as well as intereſt calls upon you to clothe the naked, and feed the

* 2 Tim. ch. iv. ver. 2. † Pſ. cxliv. ver. 13, 14.

hungry,

hungry, by perſuading them to *eat* (in the Apoſtle's phraſe) *their own bread*, or, as the *Pſalmiſt* expreſſeth it, *the labour of their own hands.* By inſpiring your flocks with a love of induſtry, you will at once ſtrike at the root of many vices, and diſpoſe them to practiſe many virtues. This therefore is the readieſt way to improve them.

Conſult your ſuperiors. They ſhall tell you the doctrine here delivered is a ſound catholic doctrine, not limited to *Proteſtants*, but extending to all, and admitted by all, whether *Proteſtants* or *Roman Catholics*, *Chriſtians* or *Mahometans*, *Jews* or *Gentiles.* And as it is of the greateſt extent, ſo it is alſo of the higheſt importance. St. *Paul* expreſly ſaith, *That if any provide not for his own, and eſpecially for thoſe of his own houſe, he hath denied the faith, and is worſe than an infidel.* *

In vain then do you endeavour to make men orthodox in points of faith, if at the ſame time in the eyes of *Chriſt* and his *Apoſtles*, you ſuffer them to be worſe than infidels, than thoſe who have no faith at all. There is ſomething it ſeems worſe than even infidelity; and to incite and ſtimulate you to put away that curſed thing from among you, is the deſign and aim of this *Addreſs.* The doctrine we recommend is an evident branch of the law of nature; it was taught by prophets, inculcated by apoſtles, encouraged and enforced by philoſophers, legiſlators, and all wiſe ſtates, in all ages, and in all parts of the world. Let me therefore intreat you to exert yourſelves, *to be inſtant in ſeaſon, and out of ſeaſon, rebuke, reprove, exhort.* Take all opportunities to drive the lion out of the way; raiſe your voices, omit no occaſion, public or private, of awakening your wretched countrymen from their ſweet dream of ſloth.

Many ſuſpect your religion to be the cauſe of that notorious idleneſs, which prevails ſo generally among the natives of this iſland, as if the *Ro-*

* 1 Tim. ch. v. ver. 8.

man

man Catholic faith was inconſiſtent with an honeſt diligence in a man's calling. But whoever conſiders the great ſpirit of induſtry that reigns in *Flanders* and *France*, and even beyond the *Alps*, muſt acknowledge this to be a groundleſs ſuſpicion. In *Piedmont* and *Genoa*, in the *Milaneſe* and the *Venetian* ſtate, and indeed throughout all *Lombardy*, how well is the ſoil cultivated, and what manufactures of ſilk, velvet, paper, and other commodities flouriſh? The king of *Sardinia* will ſuffer no idle hands in his territories, no beggar to live by the ſweat of another's brow; it has even been made penal at *Turin*, to relieve a ſtrolling beggar. To which I might add, that the perſon whoſe authority will be of the greateſt weight with you, even the *Pope* himſelf, is at this day endeavouring to put new life into the trade and manufactures of his country.

Though I am in no ſecret of the court of *Rome*, yet I will venture to affirm, that neither *Pope*, nor *Cardinals*, will be pleaſed to hear, that thoſe of their communion are diſtinguiſhed above all others, by ſloth, dirt, and beggary; or be diſpleaſed at your endeavouring to reſcue them from the reproach of ſuch an infamous diſtinction.

The caſe is as clear as the ſun; what we urge is enforced by every motive that can work on a reaſonable mind. The good of your country, your own private intereſt, the duty of your function, the cries and diſtreſſes of the poor do with one voice call for your aſſiſtance. And if it is on all hands allowed to be right and juſt, if agreeable both to reaſon and religion, if coincident with the views both of your temporal and ſpiritual ſuperiors, it is to be hoped, *this Addreſs* may find a favourable reception, and that a zeal for diſputed points, will not hinder your concurring to propagate ſo plain and uſeful a doctrine, wherein we are all agreed.

When a leak is to be ſtopped, or a fire extinguiſhed, do not all hands co-operate without diſtinction of ſect or party? Or if I am fallen into a ditch,

ditch, ſhall I not ſuffer a man to help me out, until I have firſt examined his creed? Or when I am ſick, ſhall I refuſe the phyſic, becauſe my phyſician doth, or doth not believe the *Pope's* ſupremacy?

Fas eſt et ab hoſte doceri. But in truth, I am no enemy to your perſons, whatever I may think of your tenets. On the contrary, I am your ſincere well-wiſher. I conſider you as my countrymen, as fellow-ſubjects, as profeſſing belief in the ſame *Chriſt*. And I do moſt ſincerely wiſh, there was no other conteſt between us but *Who ſhall moſt completely practiſe the precepts of him by whoſe name we are called, and whoſe diſciples we all profeſs to be.*

A

LETTER

TO THE

ROMAN CATHOLICS

OF THE

DIOCESE OF CLOYNE.

Publiſhed in the late Rebellion, A. D. 1745.

A

LETTER, &c.

My countrymen and fellow-ſubjects,

NOtwithſtanding the differences of our religious opinions, I ſhould be ſorry to be wanting in any inſtance of humanity, or good neighbourhood to any of you. For which reaſon I find myſelf ſtrongly inclined, at this critical juncture, to put you in mind, that you have been treated with a truly chriſtian lenity under the preſent government, that your perſons have been protected, and your properties ſecured by equal laws, and that it would be highly imprudent as well as ungrateful to forfeit theſe advantages, by making yourſelves tools to the ambition of foreign princes, who fancy it expedient to raiſe diſturbances among us at preſent, but as ſoon as their own ends are ſerved, will not fail to abandon you, as they have always done.

Is it not evident that your true intereſt conſiſts in lying ſtill, and waiting the event, ſince *Ireland* muſt neceſſarily follow the fate of *England*; and that therefore prudence and policy preſcribe quiet to the Roman catholics of this kingdom, who, in caſe a change of hands ſhould not ſucceed, after your attempting to bring it about, muſt then expect to be on a worſe foot than ever?

But we will ſuppoſe it ſucceeds to your wiſh. What then? Would not this undermine even your own intereſts and fortune, which are often interwoven with thoſe of your neighbours? Would not all thoſe, who have debts or money, or other effects in the hands of Proteſtants, be fellow-ſufferers with them? Would not all thoſe who hold under the acts of ſettlement, be as liable as Proteſtants themſelves to be diſpoſſeſſed by the old proprietors? Or, can even thoſe who are ſtyled proprietors, flatter themſelves with hopes of poſſeſſing the eſtates which they claim, which, in all likelihood, would be given to favourites, (perhaps to foreigners) who are near the perſon, or who fought the battles, of their maſter.

Under Proteſtant governments, thoſe of your communion, have formerly enjoyed a greater ſhare of the lands of this kingdom, and more ample privileges. You bore your part in the magiſtracy and the legiſlature, and could complain of no hardſhips on the ſcore of your religion. If theſe advantages have been ſince impaired or loſt, was it not by the wrong meaſures yourſelves took to enlarge them, in ſeveral ſucceſſive attempts, each of which left you weaker and in a worſe condition than you were before. And this, notwithſtanding the vaunted ſuccours of *France* and *Spain*, whoſe vain efforts in conjunction with yours conſtantly recoiled on your own heads, even when your numbers and circumſtances were far more conſiderable than they now are.

You all know theſe things to be true. I appeal to your own breaſts. Dear bought experience hath taught you, and paſt times inſtruct the preſent. But perhaps you follow conſcience rather than intereſt. Will any men amongſt you pretend to plead conſcience againſt being quiet, or againſt paying allegiance and peaceable ſubmiſſion to a Proteſtant prince, which the firſt chriſtians paid even to heathen, and which thoſe of your communion, at this day, pay to Mahometan and to idolatrous princes in *Turkey*

Turkey and *China*, and which you yourſelves have ſo often profeſſed to pay to our preſent gracious ſovereign? Conſcience is quite out of the caſe. And what man in his ſenſes would engage in a dangerous courſe, to which neither intereſt doth invite, nor conſcience oblige him?

I heartily wiſh, that this advice may be as well taken, as it is meant, and that you may maturely conſider your true intereſt, rather than raſhly repeat the ſame errors which you have ſo often repented of. So recommending you to the merciful guidance of Almighty God, I ſubſcribe myſelf,

Your real well-wiſher,

George Cloyne.

MAXIMS

CONCERNING

PATRIOTISM.

MAXIMS, &c.

1. EVERY man, by conſulting his own heart, may eaſily know whether he is or is not a patriot. But it is not ſo eaſy for the by-ſtanders.

2. Being loud and vehement either againſt a court, or for a court, is no proof of patriotiſm.

3. A man whoſe paſſion for money runs high, bids fair for being no patriot. And he likewiſe whoſe appetite is keen for power.

4. A native than a foreigner, a married man than a bachelor, a believer than an infidel, have a better chance for being patriots.

5. It is impoſſible an epicure ſhould be a patriot.

6. It is impoſſible a man who cheats at cards, or cogs the dice, ſhould be a patriot.

7. It is impoſſible a man who is falſe to his friends and neighbours ſhould be true to the public.

8. Every knave is a thorough knave. And a thorough knave is a knave throughout.

9. A man who hath no ſenſe of God or conſcience: would you make ſuch a one guardian to your child? if not, why guardian to the ſtate?

10. A ſot, a beaſt, benummed and ſtupified by exceſs, is good for nothing, much leſs to make a patriot of.

11. A fop or man of pleaſure makes but a ſcurvy patriot.

12. A ſullen, churliſh man, who loves no body, will hardly love his country.

13. The love of praiſe and eſteem may do ſomething: but to make a true patriot there muſt be an inward ſenſe of duty and conſcience.

14. Honeſty (like other things) grows from its proper ſeed, good principles early laid in the mind.

15. To be a real patriot, a man muſt conſider his countrymen as God's creatures, and himſelf as accountable for his acting towards them.

16. If *pro aris et focis* be the life of patriotiſm, he who hath no religion or no home makes a ſuſpected patriot.

17. No man perjures himſelf for the ſake of conſcience.

18. There is an eaſy way of reconciling malecontents.—*Sunt verba & voces quibus hunc lenire dolorem*, &c.

19. A good groom will rather ſtroke than ſtrike.

20. He who ſaith there is no ſuch thing as an honeſt man, you may be ſure is himſelf a knave.

21. I have no opinion of your bumper patriots. Some eat, ſome drink, ſome quarrel for their country. MODERN PATRIOTISM!

22. *Ibycus* is a carking, griping, cloſefiſted fellow. It is odds that *Ibycus* is not a patriot.

23. We are not to think every clamorous haranguer, or every ſplenetic repiner againſt a court, is therefore a patriot.

24. A

24. A patriot is one who heartily wiſheth the public proſperity, and doth not only wiſh, but alſo ſtudy and endeavour to promote it.

25. Gameſters, fops, rakes, bullies, ſtock-jobbers: alas! what patriots?

26. Some writers have thought it impoſſible that men ſhould be brought to laugh at public ſpirit. Yet this hath been done in the preſent age.

27. The patriot aims at his private good in the public. The knave makes the public ſubſervient to his private intereſt. The former conſiders himſelf as part of a whole, the latter conſiders himſelf as the whole.

28. There is and ever will be a natural ſtrife between court and country. The one will get as much, and the other give as little as it can. How muſt the patriot behave himſelf?

29. He gives the neceſſary. If he gives more it is with a view of gaining more to his country.

30. A patriot will never barter the public money for his private gain.

31. Moral evil is never to be committed, phyſical evil may be incurred, either to avoid a greater evil, or to procure a good.

32. Where the heart is right, there is true patriotiſm.

33. In your man of buſineſs, it is eaſier to meet with a good head than a good heart.

34. A patriot will admit there may be honeſt men, and that honeſt men may differ.

35. He that always blames, or always praiſes is no patriot.

36. Were all ſweet and ſneaking courtiers, or were all ſour malecontents; in either caſe the public would thrive but ill.

37. A patriot would hardly wiſh there was no contraſt in the ſtate.

38. Ferments of the worſt kind ſucceed to perfect inaction.

39. A man rages, rails and raves; I ſuſpect his patriotiſm.

40. The fawning courtier and the ſurly 'ſquire often mean the ſame thing, each his own intereſt.

41. A patriot will eſteem no man for being of his party.

42. The factious man is apt to miſtake himſelf for a patriot.

THE

QUERIST.

CONTAINING,

SEVERAL QUERIES,

PROPOSED TO THE

CONSIDERATION OF THE PUBLIC.

ADVERTISEMENT

By the AUTHOR.

THE QUERIST was firſt printed in the year one thouſand ſeven hundred and thirty-five; ſince which time, the face of things is ſomewhat changed. In this edition, ſome alterations have been made. The three parts are publiſhed in one; ſome few Queries are added, and many omitted, particularly, of thoſe relating to the ſketch or plan of a national bank; which it may be time enough to take again in hand, when the public ſhall ſeem diſpoſed to make uſe of ſuch an expedient. I had determined with myſelf never to prefix my name to the Queriſt, but in the laſt edition was over-ruled by a friend, who was remarkable for purſuing the public intereſt with as much diligence, as others do their own. I apprehend the ſame cenſure on this, that I incurred upon another occaſion, for meddling out of my profeſſion. Though to feed the hungry and clothe the naked, by promoting an honeſt induſtry, will, perhaps, be deemed no improper employment for a clergyman, who ſtill thinks himſelf a member of the commonwealth. As the ſum of human happineſs is ſuppoſed to conſiſt in the goods of mind, body, and fortune, I would fain make my ſtudies of ſome uſe to mankind, with regard to each of theſe three particulars, and hope it will not be thought faulty or indecent in any man, of what profeſſion ſoever, to offer his mite towards improving the manners, health, and proſperity of his fellow-creatures.

THE

QUERIST.

Qu. 1. WHETHER there ever was, is, or will be, an induſtrious nation poor, or an idle rich?

2. Whether a people can be called poor, where the common ſort are well fed, clothed and lodged?

3. Whether the drift and aim of every wiſe ſtate ſhould not be, to encourage induſtry in its members? And, whether thoſe, who employ neither heads nor hands for the common benefit, deſerve not to be expelled like drones out of a well governed ſtate?

4. Whether the four elements, and man's labour therein, be not the true ſource of wealth?

5. Whether money be not only ſo far uſeful, as it ſtirreth up induſtry, enabling men mutually to participate the fruits of each other's labour?

6. Whether any other means, equally conducing to excite and circulate the induſtry of mankind, may not be as uſeful as money?

7. Whether the real end and aim of men be not power? And whether he who could have every thing elſe at his wiſh or will, would value money?

8. Whether

8. Whether the public aim in every well governed ſtate be not, that each member, according to his juſt pretenſions and induſtry, ſhould have power?

9. Whether power be not referred to action; and whether action doth not follow appetite or will?

10. Whether faſhion doth not create appetites; and whether the prevailing will of a nation is not the faſhion?

11. Whether the current of induſtry and commerce be not determined by this prevailing will?

12. Whether it be not owing to cuſtom, that the faſhions are agreeable?

13. Whether it may not concern the wiſdom of the legiſlature to interpoſe in the making of faſhions; and not leave an affair of ſo great influence, to the management of women and fops, taylors and vintners?

14. Whether reaſonable faſhions are a greater reſtraint on freedom than thoſe which are unreaſonable?

15. Whether a general good taſte in a people would not greatly conduce to their thriving? And whether an uneducated gentry be not the greateſt of national evils?

16. Whether cuſtoms and faſhions do not ſupply the place of reaſon, in the vulgar of all ranks? Whether, therefore, it doth not very much import that they ſhould be wiſely framed?

17. Whether the imitating thoſe neighbours in our faſhions, to whom we bear no likeneſs in our circumſtances, be not one cauſe of diſtreſs to this nation?

18. Whether

18. Whether frugal faſhions in the upper rank, and comfortable living in the lower, be not the means to multiply inhabitants?

19. Whether the bulk of our *Iriſh* natives are not kept from thriving, by that cynical content in dirt and beggary, which they poſſeſs to a degree beyond any other people in Chriſtendom?

20. Whether the creating of wants be not the likelieſt way to produce induſtry in a people? And whether, if our peaſants were accuſtomed to eat beef and wear ſhoes, they would not be more induſtrious?

21. Whether other things being given, as climate, ſoil, *&c.* the wealth be not proportioned to the induſtry, and this to the circulation of credit, be the credit circulated or transferred by what marks or tokens ſoever?

22. Whether, therefore, leſs money, ſwiftly circulating, be not, in effect, equivalent to more money ſlowly circulating? Or, whether, if the circulation be reciprocally as the quantity of coin, the nation can be a loſer?

23. Whether money is to be conſidered as having an intrinſic value, or as being a commodity, a ſtandard, a meaſure, or a pledge, as is variouſly ſuggeſted by writers? And whether the true idea of money, as ſuch, be not altogether that of a ticket or counter?

24. Whether the value or price of things, be not a compounded proportion, directly as the demand, and reciprocally as the plenty?

25. Whether the terms crown, livre, pound ſterling, *&c.* are not to be conſidered as exponents or denominations of ſuch proportion? And whether gold, ſilver, and paper, are not tickets or counters for reckoning, recording, and transferring thereof?

26. Whether the denominations being retained, although the bullion

were gone, things might not nevertheleſs be rated, bought and ſold, induſtry promoted, and a circulation of commerce maintained?

27. Whether an equal raiſing of all ſorts of gold, ſilver, and copper coin, can have any effect in bringing money into the kingdom? And whether altering the proportions between the ſeveral ſorts, can have any other effect, but multiplying one kind and leſſening another, without any increaſe of the ſum total?

28. Whether arbitrary changing the denomination of coin, be not a public cheat?

29. What makes a wealthy people? Whether mines of gold and ſilver are capable of doing this? And whether the negroes amidſt the gold ſands of *Africa*, are not poor and deſtitute?

30. Whether there be any virtue in gold or ſilver, other than as they ſet people at work, or create induſtry?

31. Whether it be not the opinion or will of the people, exciting them to induſtry, that truly enricheth a nation? And whether this doth not principally depend on the means for counting, transferring, and preſerving power, that is, property of all kinds?

32. Whether if there was no ſilver or gold in the kingdom, our trade might not nevertheleſs ſupply bills of exchange, ſufficient to anſwer the demands of abſentees in *England*, or elſewhere?

33. Whether current bank-notes may not be deemed money? And whether they are not actually the greater part of the money of this kingdom?

34. Provided the wheels move, whether it is not the ſame thing, as to the effect of the machine, be this done by the force of wind, or water, or animals?

35. Whether

35. Whether power to command the induſtry of others be not real wealth? And whether money be not in truth, tickets or tokens for conveying and recording ſuch power, and whether it be of great conſequence what materials the tickets are made of?

36. Whether trade, either foreign or domeſtic, be in truth any more than this commerce of induſtry?

37. Whether to promote, transfer, and ſecure this commerce, and this property in human labour, or, in other words, this power, be not the ſole means of enriching a people, and how far this may be done independently of gold and ſilver?

38. Whether it were not wrong to ſuppoſe land itſelf to be wealth? And whether the induſtry of the people is not firſt to be conſidered, as that which conſtitutes wealth, which makes even land and ſilver to be wealth, neither of which would have any value, but as means and motives to induſtry?

39. Whether in the waſtes of *America*, a man might not poſſeſs twenty miles ſquare of land, and yet want his dinner, or a coat to his back?

40. Whether a fertile land, and the induſtry of its inhabitants, would not prove inexhauſtible funds of real wealth, be the counters for conveying and recording thereof what you will, paper, gold, or ſilver?

41. Whether a ſingle hint be ſufficient to overcome a prejudice? And whether even obvious truths will not ſometimes bear repeating?

42. Whether if human labour be the true ſource of wealth, it doth not follow that idleneſs ſhould of all things be diſcouraged in a wiſe ſtate?

43. Whether even gold, or ſilver, if they ſhould leſſen the induſtry of its inhabitants, would not be ruinous to a country? And whether *Spain* be not an inſtance of this?

44. Whether the opinion of men, and their induſtry conſequent thereupon, be not the true wealth of *Holland*, and not the ſilver ſuppoſed to be depoſited in the bank at *Amſterdam?*

45. Whether there is in truth any ſuch treaſure lying dead? And whether it be of great conſequence to the public, that it ſhould be real, rather than notional?

46. Whether in order to underſtand the true nature of wealth and commerce, it would not be right to conſider a ſhip's crew caſt upon a deſert iſland, and by degrees forming themſelves to buſineſs and civil life, while induſtry begot credit, and credit moved to induſtry?

47. Whether ſuch men would not all ſet themſelves to work? Whether they would not ſubſiſt by the mutual participation of each other's induſtry? Whether when one man had in his way procured more than he could conſume, he would not exchange his ſuperfluities to ſupply his wants? Whether this muſt not produce credit? Whether to facilitate theſe conveyances, to record and circulate this credit, they would not ſoon agree on certain tallies, tokens, tickets, or counters?

48. Whether reflection in the better ſort might not ſoon remedy our evils? And whether our real defect be not a wrong way of thinking?

49. Whether it would not be an unhappy turn in our gentlemen, if they ſhould take more thought to create an intereſt to themſelves in this or that county, or borough, than to promote the real intereſt of their country?

50. Whether if a man builds a houſe he doth not in the firſt place provide a plan which governs his work? And ſhall the public act without an end, a view, a plan?

51. Whether

51. Whether by how much the leſs particular folk think for themſelves, the public be not ſo much the more obliged to think for them?

52. Whether ſmall gains be not the way to great profit? And if our tradeſmen are beggars, whether they may not thank themſelves for it?

53. Whether ſome way might not be found for making criminals uſeful in public works, inſtead of ſending them either to *America*, or to the other world?

54. Whether we may not, as well as other nations, contrive employment for them? And whether ſervitude, chains, and hard labour, for a term of years, would not be a more diſcouraging, as well as a more adequate puniſhment for felons, than even death itſelf?

55. Whether there are not ſuch things in *Holland* as bettering houſes, for bringing young gentlemen to order? And whether ſuch an inſtitution would be uſeleſs among us?

56. Whether it be true, that the poor in *Holland* have no reſource but their own labour, and yet there are no beggars in their ſtreets?

57. Whether he whoſe luxury conſumeth foreign products, and whoſe induſtry produceth nothing domeſtic to exchange for them, is not ſo far forth injurious to his country?

58. Whether neceſſity is not to be hearkened to before convenience, and convenience before luxury?

59. Whether to provide plentifully for the poor, be not feeding the root, the ſubſtance whereof will ſhoot upwards into the branches, and cauſe the top to flouriſh?

60. Whether there be any inſtance of a ſtate wherein the people, living neatly and plentifully, did not aſpire to wealth?

61. Whether

61. Whether naſtineſs and beggary do not, on the contrary, extinguiſh all ſuch ambition, making men liſtleſs, hopeleſs, and ſlothful?

62. Whether a country inhabited by people well fed, clothed and lodged, would not become every day more populous? And whether a numerous ſtock of people in ſuch circumſtances would not conſtitute a flouriſhing nation; and how far the product of our own country may ſuffice for the compaſſing of this end?

63. Whether a people, who had provided themſelves with the neceſſaries of life in good plenty, would not ſoon extend their induſtry to new arts and new branches of commerce?

64. Whether thoſe ſame manufactures which *England* imports from other countries, may not be admitted from *Ireland?* And, if ſo, whether lace, carpets, and tapeſtry, three conſiderable articles of *Engliſh* importation, might not find encouragement in *Ireland?* And whether an academy for deſign might not greatly conduce to the perfecting thoſe manufactures among us?

65. Whether *France* and *Flanders* could have drawn ſo much money from *England*, for figured ſilks, lace, and tapeſtry, if they had not had academies for deſigning?

66. Whether when a room was once prepared, and models in plaiſter of *Paris*, the annual expence of ſuch an academy need ſtand the public in above two hundred pounds a year?

67. Whether our linen-manufacture would not find the benefit of this inſtitution? And whether there be any thing that makes us fall ſhort of the *Dutch*, in damaſks, diapers, and printed linen, but our ignorance in deſign?

68. Whether

68. Whether thoſe, who may ſlight this affair as notional, have ſufficiently conſidered the extenſive uſe of the art of deſign, and its influence in moſt trades and manufactures, wherein the forms of things are often more regarded than the materials? *

69. Whether there be any art ſooner learned than that of making carpets? And whether our women, with little time and pains, may not make more beautiful carpets than thoſe imported from *Turkey*? And whether this branch of the woollen-manufacture be not open to us?

70. Whether human induſtry can produce, from ſuch cheap materials, a manufacture of ſo great value, by any other art, as by thoſe of ſculpture and painting?

71. Whether pictures and ſtatues are not in fact ſo much treaſure? And whether *Rome* and *Florence* would not be poor towns without them?

72. Whether they do not bring ready money, as well as jewels? Whether in *Italy*, debts are not paid, and children portioned with them, as with gold and ſilver?

73. Whether it would not be more prudent, to ſtrike out and exert ourſelves in permitted branches of trade, than to fold our hands and repine, that we are not allowed the woollen?

74. Whether it be true, that two millions are yearly expended by *England* by foreign lace and linen?

75. Whether immenſe ſums are not drawn yearly into the *Northern* countries, for ſupplying the *Britiſh* navy with hempen manufactures?

76. Whether there be any thing more profitable than hemp? And whether there ſhould not be great premiums for encouraging our hempen-

* Since the firſt Publication of this Query, the Art of Deſign ſeems to be more conſidered and countenanced among us.

trade?

trade? What advantages may not *Great-Britain* make of a country where land and labour are ſo cheap?

77. Whether *Ireland* alone might not raiſe hemp ſufficient for the *Britiſh* navy? And whether it would not be vain to expect this from the *Britiſh* colonies in *America*, where hands are ſo ſcarce, and labour ſo exceſſively dear?

78. Whether if our own people want will or capacity for ſuch an attempt, it might not be worth while for ſome undertaking ſpirits in *England* to make ſettlements, and raiſe hemp in the counties of *Clare* and *Limerick*, than which, perhaps, there is not fitter land in the world for that purpoſe? And whether both nations would not find their advantage therein?

79. Whether if all the idle hands in this kingdom were employed on hemp and flax, we might not find ſufficient vent for theſe manufactures?

80. How far it may be in our own power to better our affairs, without interfering with our neighbours?

81. Whether the prohibition of our woollen-trade, ought not naturally to put us on other methods, which give no jealouſy?

82. Whether paper be not a valuable article of commerce? And whether it be not true, that one ſingle bookſeller in *London* yearly expended above four thouſand pounds in that foreign commodity?

83. How it comes to paſs that the *Venetians* and *Genoeſe*, who wear ſo much leſs linen, and ſo much worſe than we do, ſhould yet make very good paper, and in great quantity, while we make very little?

84. How long it will be before my countrymen find out, that it is worth while to ſpend a penny, in order to get a groat?

85. If

85. If all the land were tilled that is fit for tillage, and all that ſowed with hemp and flax that is fit for raiſing them, whether we ſhould have much ſheep-walk beyond what was ſufficient to ſupply the neceſſities of the kingdom?

86. Whether other countries have not flouriſhed without the woollen-trade?

87. Whether it be not a ſure ſign, or effect of a country's thriving, to ſee it well cultivated and full of inhabitants? And if ſo, whether a great quantity of ſheep-walk, be not ruinous to a country, rendering it waſte and thinly inhabited?

88. Whether the employing ſo much of our land under ſheep, be not in fact an *Iriſh* blunder?

89. Whether our hankering after our woollen-trade, be not the true and only reaſon, which hath created a jealouſy in *England* towards *Ireland?* And whether any thing can hurt us more than ſuch jealouſy?

90. Whether it be not the true intereſt of both nations, to become one people? And whether either be ſufficiently apprized of this?

91. Whether the upper part of this people are not truly *Engliſh*, by blood, language, religion, manners, inclination and intereſt?

92. Whether we are not as much *Engliſhmen*, as the children of old *Romans* born in *Britain*, were ſtill *Romans?*

93. Whether it be not our true intereſt, not to interfere with them; and, in every other caſe, whether it be not their true intereſt to befriend us?

94. Whether a mint in *Ireland* might not be of great convenience to the kingdom; and whether it could be attended with any poſſible inconvenience to *Great-Britain?* And whether there were not mints in *Naples*

and in *Sicily*, when thoſe kingdoms were provinces to *Spain*, or the houſe of *Auſtria*?

95. Whether any thing can be more ridiculous, than for the *North* of *Ireland* to be jealous of a linen-manufacture in the *South*?

96. Whether the county of *Tipperary* be not much better land than the county of *Armagh*; and yet whether the latter is not much better improved and inhabited than the former?

97. Whether every landlord in the kingdom doth not know the cauſe of this? And yet how few are the better for ſuch their knowledge?

98. Whether large farms under few hands, or ſmall ones under many, are likely to be made moſt of? And whether flax and tillage do not naturally multiply hands, and divide land into ſmall holdings, and well-improved?

99. Whether, as our exports are leſſened, we ought not to leſſen our imports? And whether theſe will not be leſſened as our demands, and theſe as our wants, and theſe as our cuſtoms or faſhions? Of how great conſequence therefore are faſhions to the public?

100. Whether it would not be more reaſonable to mend our ſtate than to complain of it; and how far this may be in our own power?

101. What the nation gains by thoſe who live in *Ireland* upon the produce of foreign countries?

102. How far the vanity of our ladies in dreſſing, and of our gentlemen in drinking, contributes to the general miſery of the people?

103. Whether nations as wiſe and opulent as ours, have not made ſumptuary laws; and what hinders us from doing the ſame?

104. Whether

104. Whether thoſe who drink foreign liquors, and deck themſelves and their families with foreign ornaments, are not ſo far forth to be reckoned abſentees?

105. Whether as our trade is limited, we ought not to limit our expences; and whether this be not the natural and obvious remedy?

106. Whether the dirt, and famine, and nakedneſs of the bulk of our people, might not be remedied, even although we had no foreign trade? And whether this ſhould not be our firſt care; and whether, if this were once provided for, the conveniencies of the rich would not ſoon follow?

107. Whether comfortable living doth not produce wants, and wants induſtry, and induſtry wealth?

108. Whether there is not a great difference between *Holland* and *Ireland?* And whether foreign commerce, without which the one could not ſubſiſt, be ſo neceſſary for the other?

109. Might we not put a hand to the plough, or the ſpade, although we had no foreign commerce?

110. Whether the exigencies of nature are not to be anſwered by induſtry on our own ſoil? And how far the conveniencies and comforts of life may be procured, by a domeſtic commerce between the ſeveral parts of this kingdom?

111. Whether the women may not ſew, ſpin, weave, embroider, ſufficiently for the embelliſhment of their perſons, and even enough to raiſe envy in each other, without being beholden to foreign countries?

112. Suppoſe the bulk of our inhabitants had ſhoes to their feet, clothes to their backs, and beef in their bellies? Might not ſuch a ſtate be eligible for the public, even though the 'ſquires were condemned to drink ale and cyder?

113. Whether if drunkenneſs be a neceſſary evil, men may not as well drink the growth of their own country?

114. Whether a nation within itſelf might not have real wealth, ſufficient to give its inhabitants power and diſtinction, without the help of gold and ſilver?

115. Whether, if the arts of ſculpture and painting were encouraged among us, we might not furniſh our houſes in a much nobler manner with our own manufactures?

116. Whether we have not, or may not have, all the neceſſary materials for building at home?

117. Whether tiles and plaiſter may not ſupply the place of *Norway* fir, for flooring and wainſcot?

118. Whether plaiſter be not warmer, as well as more ſecure, than deal? And whether a modern faſhionable houſe, lined with fir, daubed over with oil and paint, be not like a fire-ſhip, ready to be lighted up by all accidents?

119. Whether larger houſes, better built and furniſhed, a greater train of ſervants, the difference with regard to equipage and table, between finer and coarſer, more and leſs elegant, may not be ſufficient to feed a reaſonable ſhare of vanity, or ſupport all proper diſtinctions? And whether all theſe may not be procured, by domeſtic induſtry out of the four elements, without ranſacking the four quarters of the globe?

120. Whether any thing is a nobler ornament, in the eye of the world, than an *Italian* palace, that is, ſtone and mortar ſkilfully put together, and adorned with ſculpture and painting; and whether this may not be compaſſed without foreign trade?

121. Whether

121. Whether an expence in gardens and plantations would not be an elegant diſtinction for the rich, a domeſtic magnificence, employing many hands within, and drawing nothing from abroad?

122. Whether the apology which is made for foreign luxury in *England*, to wit, that they could not carry on their trade without imports as well as exports, will hold in *Ireland?*

123. Whether one may not be allowed to conceive and ſuppoſe a ſociety, or nation of human creatures, clad in woollen cloths and ſtuffs, eating good bread, beef and mutton, poultry and fiſh in great plenty, drinking ale, mead and cyder, inhabiting decent houſes built of brick and marble, taking their pleaſure in fair parks and gardens, depending on no foreign imports either for food, or raiment? And whether ſuch people ought much to be pitied?

124. Whether *Ireland* be not as well qualified for ſuch a ſtate, as any nation under the ſun?

125. Whether in ſuch a ſtate the inhabitants may not contrive to paſs the twenty-four hours, with tolerable eaſe and chearfulneſs? And whether any people upon earth can do more?

126. Whether they may not eat, drink, play, dreſs, viſit, ſleep in good beds, ſit by good fires, build, plant, raiſe a name, make eſtates, and ſpend them?

127. Whether upon the whole, a domeſtic trade may not ſuffice in ſuch a country as *Ireland*, to nouriſh and clothe its inhabitants, and provide them with the reaſonable conveniencies, and even comforts of life?

128. Whether a general habit of living well, would not produce numbers and induſtry; and whether, conſidering the tendency of human kind,

kind, the conſequence thereof would not be foreign trade and riches, how unneceſſary ſoever?

129. Whether, nevertheleſs, it be a crime to enquire how far we may do without foreign trade, and what would follow on ſuch a ſuppoſition?

130. Whether the number and welfare of the ſubjects be not the true ſtrength of the crown?

131. Whether in all public inſtitutions, there ſhould not be an end propoſed, which is to be the rule and limit of the means? Whether this end ſhould not be the well-being of the whole? And whether, in order to this, the firſt ſtep ſhould not be to clothe and feed our people?

132. Whether there be upon earth any chriſtian, or civilized people, ſo beggarly, wretched, and deſtitute, as the common *Iriſh?*

133. Whether, nevertheleſs, there is any other people whoſe wants may be more eaſily ſupplied from home?

134. Whether, if there was a wall of braſs a thouſand cubits high, round this kingdom, our natives might not nevertheleſs live cleanly and comfortably, till the land and reap the fruits of it?

135. What ſhould hinder us from exerting ourſelves, uſing our hands and brains, doing ſomething or other, man, woman and child, like the other inhabitants of God's earth?

136. Be the reſtraining our trade well or ill adviſed in our neighbours, with reſpect to their own intereſt, yet whether it be not plainly ours to accommodate ourſelves to it?

137. Whether it be not vain to think of perſuading other people to ſee their intereſt, while we continue blind to our own?

138. Whether

138. Whether there be any other nation poſſeſſed of ſo much good land, and ſo many able hands to work it, which yet is beholden for bread to foreign countries?

139. Whether it be true, that we import corn to the value of two hundred thouſand pounds in ſome years? *

140. Whether we are not undone by faſhions made for other people? And whether it be not madneſs in a poor nation to imitate a rich one?

141. Whether a woman of faſhion ought not to be declared a public enemy?

142. Whether it be not certain, that from the ſingle town of *Cork* were exported, in one year, no leſs than one hundred and ſeven thouſand one hundred ſixty-one barrels of beef; ſeven thouſand three hundred and ſeventy-nine barrels of pork; thirteen thouſand four hundred and ſixty-one caſks, and eighty-five thouſand ſeven hundred and twenty-ſeven firkins of butter? And what hands were employed in this manufacture?

143. Whether a foreigner could imagine, that one half of the people were ſtarving, in a country which ſent out ſuch plenty of proviſions?

144. Whether an *Iriſh* lady, ſet out with *French* ſilks, and *Flanders* lace, may not be ſaid to conſume more beef and butter than a hundred of our labouring peaſants?

145. Whether nine tenths of our foreign trade be not carried on ſingly to ſupport the article of vanity?

146. Whether it can be hoped, that private perſons will not indulge this folly, unleſs reſtrained by the public?

* Things are now better in reſpect of this particular, and ſome others, than they were when the *Queriſt* was firſt publiſhed.

147. How

147. How vanity is maintained in other countries? Whether in *Hungary*, for inſtance, a proud nobility are not ſubſiſted with ſmall imports from abroad?

148. Whether there be a prouder people upon earth than the noble *Venetians*, although they all wear plain black clothes?

149. Whether a people are to be pitied, that will not ſacrifice their little particular vanities to the public good? And yet, whether each part would not except their own foible from this public ſacrifice, the 'ſquire his bottle, the lady her lace?

150. Whether claret be not often drank rather for vanity than for health, or pleaſure?

151. Whether it be true, that men of nice palates have been impoſed on, by elder wine for *French* claret, and by mead for palm ſack?

152. Do not *Engliſhmen* abroad purchaſe beer and cyder at ten times the price of wine?

153. How many gentlemen are there in *England* of a thouſand pounds *per annum*, who never drink wine in their own houſes? Whether the ſame may be ſaid of any in *Ireland* who have even one hundred pounds *per annum?*

154. What reaſon have our neighbours in *England* for diſcouraging *French* wines, which may not hold with reſpect to us alſo?

155. How much of the neceſſary ſuſtenance of our people is yearly exported for brandy?

156. Whether, if people muſt poiſon themſelves, they had not better do it with their own growth?

157. If

157. If we imported neither claret from *France*, nor fir from *Norway*, what the nation would ſave by it?

158. When the root yieldeth inſufficient nouriſhment, whether men do not top the tree to make the lower branches thrive?

159. Whether, if our ladies drank ſage or balm tea out of *Iriſh* ware, it would be an inſupportable national calamity?

160. Whether it be really true that ſuch wine is beſt as moſt encourages drinking, *i. e.* that muſt be given in the largeſt doſe to produce its effect? And whether this holds with regard to any other medicine?

161. Whether that trade ſhould not be accounted moſt pernicious, wherein the balance is moſt againſt us? And whether this be not the trade with *France?*

162. Whether it be not even madneſs, to encourage trade with a nation that takes nothing of our manufacture?

163. Whether *Ireland* can hope to thrive, if the major part of her patriots ſhall be found in the *French* intereſt?

164. Whether great plenty and variety of excellent wines are not to be had on the coaſts of *Italy* and *Sicily?* And whether thoſe countries would not take our commodities of linen, leather, butter, *&c.* in exchange for them?

165. Particularly, whether the *Vinum Mamertinum*, which grows on the mountains about *Meſſina*, a red, generous wine, highly eſteemed (if we may credit *Pliny*) by the ancient *Romans*, would not come cheap, and pleaſe the palates of our iſlanders?

166. Why, if a bribe by the palate or the purſe be in effect the ſame thing, they ſhould not be alike infamous?

167. Whether the vanity and luxury of a few ought to ſtand in competition with the intereſt of a nation?

168. Whether national wants ought not to be the rule of trade? And whether the moſt preſſing wants of the majority ought not to be firſt conſidered?

169. Whether it is poſſible the country ſhould be well improved, while our beef is exported, and our labourers live upon potatoes?

170. If it be reſolved that we cannot do without foreign trade, whether, at leaſt, it may not be worth while to conſider what branches thereof deſerve to be entertained, and how far we may be able to carry it on under our preſent limitations?

171. What foreign imports may be neceſſary, for clothing and feeding the families of perſons not worth above one hundred pounds a year? And how many wealthier there are in the kingdom, and what proportion they bear to the other inhabitants?

172. Whether trade be not then on a right foot, when foreign commodities are imported in exchange only for domeſtic ſuperfluities?

173. Whether the quantities of beef, butter, wool and leather, exported from this iſland, can be reckoned the ſuperfluities of a country, where there are ſo many natives naked and famiſhed?

174. Whether it would not be wiſe ſo to order our trade, as to export manufactures rather than proviſions, and of thoſe ſuch as employ moſt hands?

175. Whether ſhe would not be a very vile matron, and juſtly thought either mad or fooliſh, that ſhould give away the neceſſaries of life from her naked and famiſhed children, in exchange for pearls to ſtick in her hair, and ſweet-meats to pleaſe her own palate?

176. Whether

176. Whether a nation might not be conſidered as a family?

177. Whether the remark made by a *Venetian* ambaſſador to cardinal *Richelieu—That* France *needed nothing to be rich and eaſy, but to know how to ſpend what ſhe diſſipates*——may not be of uſe alſo to other people?

178. Whether hungry cattle will not leap over bounds? And whether moſt men are not hungry in a country where expenſive faſhions obtain?

179. Whether there ſhould not be publiſhed yearly, ſchedules of our trade, containing an account of the imports and exports of the foregoing year?

180. Whether other methods may not be found for ſupplying the funds, beſides the cuſtom on things imported?

181. Whether any art or manufacture be ſo difficult as the making of good laws?

182. Whether our peers and gentlemen are born legiſlators? Or, whether that faculty be acquired by ſtudy and reflection?

183. Whether to comprehend the real intereſt of a people, and the means to procure it, doth not imply ſome fund of knowledge, hiſtorical, moral and political, with a faculty of reaſon improved by learning?

184. Whether every enemy to learning be not a *Goth?* And whether every ſuch *Goth* among us be not an enemy to the country?

185. Whether, therefore, it would not be an omen of ill preſage, a dreadful phænomenon in the land, if our great men ſhould take it in their heads to deride learning and education?

186. Whether on the contrary, it ſhould not ſeem worth while to erect a mart of literature in this kingdom, under wiſer regulations and better

diſcipline than in any other part of *Europe?* And whether this would not be an infallible means of drawing men and money into the kingdom?

187. Whether the governed be not too numerous for the governing part of our college? And whether it might not be expedient to convert thirty natives-places into twenty fellowſhips?

188. Whether if we had two colleges, there might not ſpring an uſeful emulation between them? And whether it might not be contrived, ſo to divide the fellows, ſcholars and revenues, between both, as that no member ſhould be a loſer thereby?

189. Whether ten thouſand pounds well laid out, might not build a decent college, fit to contain two hundred perſons; and whether the purchaſe-money of the chambers, would not go a good way towards defraying the expence?

190. Where this college ſhould be ſituated?

191. Whether in imitation of the Jeſuits at *Paris*, who admit proteſtants to ſtudy in their colleges, it may not be right for us alſo to admit Roman catholics into our college, without obliging them to attend chapel-duties, or catechiſms, or divinity-lectures? And whether this might not keep money in the kingdom, and prevent the prejudices of a foreign education?

192. Whether it is poſſible a ſtate ſhould not thrive, whereof the lower part were induſtrious, and the upper wiſe?

193. Whether the collected wiſdom of ages and nations be not found in books?

194. Whether *Themiſtocles* his art of making a little city, or a little people, become a great one, be learned any where ſo well as in the writings of the ancients?

195. Whether

195. Whether a wiſe ſtate hath any intereſt nearer heart, than the education of youth?

196. Whether the mind, like ſoil, doth not by diſuſe, grow ſtiff; and whether reaſoning and ſtudy be not like ſtirring and dividing the glebe?

197. Whether an early habit of reflexion, although obtained by ſpeculative ſciences, may not have its uſe in practical affairs?

198. Whether even thoſe parts of academical learning which are quite forgotten, may not have improved and enriched the ſoil, like thoſe vegetables which are raiſed, not for themſelves, but ploughed in for a dreſſing of land?

199. Whether it was not an *Iriſh* profeſſor who firſt opened the public ſchools at *Oxford?* Whether this iſland hath not been anciently famous for learning? And whether at this day it hath any better chance for being conſiderable?

200. Whether we may not with better grace ſit down and complain, when we have done all that lies in our power to help ourſelves?

201. Whether the gentleman of eſtate hath a right to be idle; and whether he ought not to be the great promoter and director of induſtry, among his tenants and neighbours?

202. Whether in the cantons of *Switzerland* all under thirty years of age are not excluded from their great councils?

203. Whether *Homer*'s compendium of education,

Μύθων μεν ῥητῆρ ἔμεναι, πρηκτῆρά τε ἔργων, Iliad ix.

would not be a good rule for modern educators of youth? And whether half the learning and ſtudy of theſe kingdoms is not uſeleſs, for want of a proper delivery and pronunciation being taught in our ſchools and colleges?

204. Whether

204. Whether in any order a good building can be made of bad materials? Or whether any form of government can make a happy ſtate out of bad individuals?

205. What was it that *Solomon* compared to a jewel of gold in a ſwine's ſnout?

206. Whether the public is more concerned in any thing than in the procreation of able citizens?

207. Whether to the multiplying of human kind, it would not much conduce, if marriages were made with good-liking?

208. Whether, if women had no portions, we ſhould then ſee ſo many unhappy and unfruitful marriages?

209. Whether the laws be not, according to *Ariſtotle*, a mind without appetite, or paſſion? And conſequently without reſpect of perſons?

210. Suppoſe a rich man's ſon marries a poor man's daughter, ſuppoſe alſo that a poor man's daughter is deluded and debauched by the ſon of a rich man; which is moſt to be pitied?

211. Whether the puniſhment ſhould be placed on the ſeduced or the ſeducer?

212. Whether a promiſe made before God and man in the moſt ſolemn manner ought to be violated?

213. Whether it was *Plato*'s opinion that *for the good of the community, rich ſhould marry with rich? de Leg.* l. 4.

214. Whether as ſeed equally ſcattered produceth a goodly harveſt, even ſo an equal diſtribution of wealth doth not cauſe a nation to flouriſh?

215. Whence

215. Whence is it that *Barbs* and *Arabs* are ſo good horſes? And whether in thoſe countries they are not exactly nice in admitting none but males of a good kind to their mares?

216. What effects would the ſame care produce in families?

217. Whether the real foundation for wealth muſt not be laid in the numbers, the frugality and the induſtry of the people? And whether all attempts to enrich a nation by other means, as raiſing the coin, ſtock-jobbing and ſuch arts, are not vain?

218. Whether a door ought not to be ſhut againſt all other methods of growing rich, ſave only by induſtry and merit? And whether wealth got otherwiſe would not be ruinous to the public?

219. Whether the abuſe of banks and paper-money is a juſt objection againſt the uſe thereof? And whether ſuch abuſe might not eaſily be prevented?

220. Whether national banks are not found uſeful in *Venice*, *Holland* and *Hamburgh?* And whether it is not poſſible to contrive one that may be uſeful alſo in *Ireland?*

221. Whether the banks of *Venice* and *Amſterdam*, are not in the hands of the public?

222. Whether it may not be worth while to inform ourſelves in the nature of thoſe banks? And what reaſon can be aſſigned, why *Ireland* ſhould not reap the benefit of ſuch public banks, as well as other countries?

223. Whether a bank of national credit, ſupported by public funds and ſecured by parliament, be a chimera or impoſſible thing; and if not, what would follow from the ſuppoſal of ſuch a bank?

224. Whether

224. Whether the currency of a credit ſo well ſecured would not be of great advantage to our trade and manufactures?

225. Whether the notes of ſuch public bank would not have a more general circulation than thoſe of private banks, as being leſs ſubject to frauds and hazards?

226. Whether it be not agreed that paper hath in many reſpects, the advantage above coin, as being of more diſpatch in payments, more eaſily transferred, preſerved, and recovered when loſt?

227. Whether, beſides theſe advantages, there be not an evident neceſſity for circulating credit by paper, from the defect of coin in this kingdom?

228. Whether it be rightly remarked by ſome, that, as banking brings no treaſure into the kingdom like trade, private wealth muſt ſink as the bank riſeth? And whether whatever cauſeth induſtry to flouriſh and circulate, may not be ſaid to increaſe our treaſure?

229. Whether the ruinous effects of Miſſiſſippi, South-Sea, and ſuch ſchemes, were not owing to an abuſe of paper-money or credit, in making it a means for idleneſs and gaming, inſtead of a motive and help to induſtry?

230. Whether the riſe of the bank of *Amſterdam* was not purely caſual, for the ſecurity and diſpatch of payments? And whether the good effects thereof, in ſupplying the place of coin, and promoting a ready circulation of induſtry and commerce, may not be a leſſon to us, to do that by deſign, which others fell upon by chance?

231. Whether plenty of ſmall caſh be not abſolutely neceſſary for keeping up a circulation among the people; that is, whether copper be not more neceſſary than gold?

232. Whether

232. Whether that, which increaſeth the ſtock of a nation, be not a means of increaſing its trade? And whether that, which increaſeth the current credit of a nation, may not be ſaid to increaſe its ſtock?

233. Whether the credit of the public funds be not a mine of gold to *England?* And whether any ſtep that ſhould leſſen this credit ought not to be dreaded?

234. Whether ſuch credit be not the principal advantage that *England* hath over *France?* I may add, over every other country in *Europe?*

235. Whether by this the public is not become poſſeſſed of the wealth of foreigners as well as natives? And whether *England* be not in ſome ſort the treaſury of Chriſtendom?

236. Whether as our current domeſtic credit grew, induſtry would not grow likewiſe; and if induſtry, our manufactures; and if theſe, our foreign credit?

237. Whether foreign demands may not be anſwered by our exports without drawing caſh out of the kingdom?

238. Whether as induſtry increaſed, our manufactures would not flouriſh; and as theſe flouriſhed, whether better returns would not be made from eſtates to their landlords, both within and without the kingdom?

239. Whether the ſure way to ſupply people with tools and materials, and to ſet them at work, be not a free circulation of money, whether ſilver or paper?

240. Whether in *New-England*, all trade and buſineſs is not as much at a ſtand, upon a ſcarcity of paper-money, as with us from the want of ſpecie?

241. Whether it be certain, that the quantity of ſilver in the bank of

Amſterdam be greater now than at firſt; but whether it be not certain that there is a greater circulation of induſtry and extent of trade, more people, ſhips, houſes, and commodities of all ſorts, more power by ſea and land?

242. Whether money, lying dead in the bank of *Amſterdam*, would not be as uſeleſs as in the mine?

243. Whether our viſible ſecurity in land could be doubted? And whether there be any thing like this in the bank of *Amſterdam?*

244. Whether it be juſt to apprehend danger from truſting a national bank with power to extend its credit, to circulate notes which it ſhall be felony to counterfeit, to receive goods on loans, to purchaſe lands, to ſell alſo or alienate them, and to deal in bills of exchange; when theſe powers are no other than have been truſted for many years with the bank of *England*, although in truth but a private bank?

245. Whether the objection from monopolies and an over-growth of power, which are made againſt private banks, can poſſibly hold againſt a national one?

246. Whether the evil effects, which, of late years have attended paper-money and credit in *Europe*, did not ſpring from ſubſcriptions, ſhares, dividends and ſtock-jobbing?

247. Whether the great evils attending paper-money in the *Britiſh* plantations of *America* have not ſprung from the over-rating their lands, and iſſuing paper without diſcretion, and from the legiſlators breaking their own rules in favour of themſelves, thus ſacrificing the public to their private benefit? And whether a little ſenſe and honeſty might not eaſily prevent all ſuch inconveniences?

248. Whether the ſubject of free-thinking in religion be not exhauſted? And whether it be not high time for our free-thinkers to turn their thoughts to the improvement of their country?

249. Whether

249. Whether it muſt not be ruinous for a nation to ſit down to game, be it with ſilver or with paper?

250. Whether, therefore, the circulating paper, in the late ruinous ſchemes of *France* and *England*, was the true evil, and not rather the circulating thereof without induſtry? And whether the bank of *Amſterdam*, where induſtry had been for ſo many years ſubſiſted and circulated by transfers on paper, doth not clearly decide this point?

251. Whether there are not to be ſeen in *America* fair towns, wherein the people are well lodged, fed and clothed, without a beggar in their ſtreets, although there be not one grain of gold or ſilver current among them?

252. Whether theſe people do not exerciſe all arts and trades, build ſhips and navigate them to all parts of the world, purchaſe lands, till and reap the fruits of them, buy and ſell, educate and provide for their children? Whether they do not even indulge themſelves in foreign vanities?

253. Whether, whatever inconveniencies thoſe people may have incurred, from not obſerving either rules or bounds in their paper-money, yet it be not certain that they are in a more flouriſhing condition, have larger and better built towns, more plenty, more induſtry, more arts and civility, and a more extenſive commerce, than when they had gold and ſilver current among them?

254. Whether a view of the ruinous effects of abſurd ſchemes and credit miſmanaged, ſo as to produce gaming and madneſs inſtead of induſtry, can be any juſt objection againſt a national bank calculated purely to promote induſtry?

255. Whether a ſcheme for the welfare of this nation ſhould not take in the whole inhabitants? And whether it be not a vain attempt, to pro-

ject the flouriſhing of our proteſtant gentry, excluſive of the bulk of the natives?

256. Whether an oath, teſtifying allegiance to the king and diſclaiming the pope's authority in temporals, may not be juſtly required of the Roman catholics? And whether, in common prudence or policy, any prieſt ſhould be tolerated who refuſeth to take it?

257. Whether there is any ſuch thing as a body of inhabitants, in any Roman catholic country under the ſun, that profeſs an abſolute ſubmiſſion to the pope's orders in matters of an indifferent nature, or that in ſuch points do not think it their duty to obey the civil government?

258. Whether ſince the peace of *Utrecht*, maſs was not celebrated, and the ſacraments adminiſtered in divers dioceſes of *Sicily*, notwithſtanding the pope's interdict?

259. Whether a ſum, which would go but a little way towards erecting hoſpitals for maintaining and educating the children of the native *Iriſh*, might not go far in binding them out apprentices to proteſtant maſters, for huſbandry, uſeful trades, and the ſervice of families?

260. Whether there be any inſtance of a people's being converted in a chriſtian ſenſe, otherwiſe than by preaching to them and inſtructing them in their own language?

261. Whether catechiſts in the *Iriſh* tongue may not eaſily be procured and ſubſiſted? And whether this would not be the moſt practicable means for converting the natives?

262. Whether it be not of great advantage to the church of *Rome*, that ſhe hath clergy ſuited to all ranks of men, in gradual ſubordination from cardinals down to mendicants?

263. Whether

263. Whether her numerous poor clergy are not very uſeful in miſſions, and of much influence with the people?

264. Whether in defect of able miſſionaries, perſons converſant in low life, and ſpeaking the *Iriſh* tongue, if well inſtructed in the firſt principles of religion and in the popiſh controverſy, though for the reſt on a level with the pariſh clerks, or the ſchoolmaſters of charity-ſchools, may not be fit to mix with and bring over our poor illiterate natives to the eſtabliſhed church? Whether it is not to be wiſhed that ſome parts of our liturgy and homilies were publicly read in the *Iriſh* language? And whether, in theſe views, it may not be right to breed up ſome of the better ſort of children in the charity-ſchools and qualify them for miſſionaries, catechiſts and readers?

265. Whether a 'ſquire poſſeſſed of land to the value of a thouſand pounds *per annum*, or a merchant worth twenty thouſand pounds in caſh would have moſt power to do good or evil upon any emergency? And whether the ſuffering Roman catholics to purchaſe forfeited lands, would not be good policy as tending to unite their intereſt with that of the government?

266. Whether the ſea-ports of *Galway*, *Limerick*, *Cork*, and *Waterford* are not to be looked on as keys of this kingdom? And whether the merchants are not poſſeſſed of theſe keys; and who are the moſt numerous merchants in thoſe cities?

267. Whether a merchant cannot more ſpeedily raiſe a ſum, more eaſily conceal or transfer his effects, and engage in any deſperate deſign with more ſafety than a landed man, whoſe eſtate is a pledge for his behaviour?

268. Whether a wealthy merchant bears not great ſway among the populace of a trading city? And whether power be not ultimately lodged in the people?

269. Whether,

269. Whether, as others have ſuppoſed an *Atlantis* or *Eutopia*, we alſo may not ſuppoſe an *hyperborean* iſland inhabited by reaſonable creatures?

270. Whether an indifferent perſon, who looks into all hands, may not be a better judge of the game than a party who ſees only his own?

271. Whether there be any country in Chriſtendom more capable of improvement than *Ireland?*

272. Whether we are not as far before other nations with reſpect to natural advantages, as we are behind them with reſpect to arts and induſtry?

273. Whether we do not live in a moſt fertile ſoil and temperate climate, and yet whether our people in general do not feel great want and miſery?

274. Whether my countrymen are not readier at finding excuſes than remedies?

275. Whether the wealth and proſperity of our country do not hang by a hair, the probity of one banker, the caution of another, and the lives of all?

276. Whether we have not been ſufficiently admoniſhed of this by ſome late events?

277. Whether a national bank would not at once ſecure our properties, put an end to uſury, facilitate commerce, ſupply the want of coin, and produce ready payments in all parts of the kingdom?

278. Whether the uſe or nature of money, which all men ſo eagerly purſue, be yet ſufficiently underſtood or conſidered by all?

279. What doth *Ariſtotle* mean by ſaying——λῆρος εἶναι δοκεῖ τὸ νόμισμα. *de Repub.* l. ix. 9.

280. Whether

280. Whether mankind are not governed by imitation rather than by reaſon?

281. Whether there be not a meaſure or limit within which gold and ſilver are uſeful, and beyond which they may be hurtful?

282. Whether that meaſure be not the circulating of induſtry?

283. Whether a diſcovery of the richeſt gold mine, that ever was, in the heart of this kingdom, would be a real advantage to us?

284. Whether it would not tempt foreigners to prey upon us?

285. Whether it would not render us a lazy, proud, and daſtardly people?

286. Whether every man who had money enough, would not be a gentleman? And whether a nation of gentlemen would not be a wretched nation?

287. Whether all things would not bear a high price? And whether men would not increaſe their fortunes without being the better for it?

288. Whether the ſame evils would be apprehended from paper-money under an honeſt and thrifty regulation?

289. Whether, therefore, a national bank would not be more beneficial than even a mine of gold?

290. Whether without private banks what little buſineſs and induſtry there is would not ſtagnate? But whether it be not a mighty privilege for a private perſon, to be able to create an hundred pounds with a daſh of his pen?

291. Whether the wiſe ſtate of *Venice* was not the firſt that conceived the advantage of a national bank?

292. Whether

292. Whether the great exactneſs and integrity, with which this bank is managed, be not the chief ſupport of that republic?

293. Whether the bank of *Amſterdam* was not begun about one hundred and thirty years ago, and whether at this day, its ſtock be not conceived to amount to three thouſand tons of gold, or thirty millions ſterling?

294. Whether all payments of contracts for goods in groſs and letters of exchange, muſt not be made by transfers in the bank books, provided the ſum exceed three hundred florins?

295. Whether it be not owing to this bank, that the city of *Amſterdam*, without the leaſt confuſion, hazard or trouble, maintains and every day promotes ſo general and quick a circulation of induſtry.

296. Whether it be not the greateſt help and ſpur to commerce, that property can be ſo readily conveyed and ſo well ſecured by a *compte en banc*, that is, by only writing one man's name for another's in the bank-book?

297. Whether at the beginning of the laſt century, thoſe who had lent money to the public during the war with *Spain*, were not ſatisfied by the ſole expedient of placing their names in a *compte en banc*, with liberty to transfer their claims?

298. Whether the example of thoſe eaſy transfers in the *compte en banc*, thus caſually erected, did not tempt other men to become creditors to the public, in order to profit by the ſame ſecure and expeditious method of keeping and transferring their wealth?

299. Whether this *compte en banc* hath not proved better than a mine of gold to *Amſterdam*?

300. Whether that city may not be ſaid to owe her greatneſs to the unpromiſing

unpromiſing accident of her having been in debt more than ſhe was able to pay?

301. Whether it be known that any ſtate from ſuch ſmall beginnings, in ſo ſhort a time, ever grew to ſo great wealth and power, as the province of *Holland* hath done; and whether the bank of *Amſterdam* hath not been the real cauſe of ſuch extraordinary growth?

302. Whether the ſucceſs of thoſe public banks in *Venice*, *Amſterdam*, and *Hamburgh*, would not naturally produce in other ſtates an inclination to the ſame methods?

303. Whether it be poſſible, for a national bank to ſubſiſt and maintain its credit, under a *French* government?

304. Whether our natural appetites, as well as powers, are not limited to their reſpective ends and uſes? But whether artificial appetites may not be infinite?

305. Whether the ſimple getting of money, or paſſing it from hand to hand without induſtry, be an object worthy of a wiſe government?

306. Whether, if money be conſidered as an end, the appetite thereof be not infinite? But whether the ends of money itſelf be not bounded?

307. Whether the total ſum of all other powers, be it of enjoyment or action, which belong to man, or to all mankind together, is not in truth a very narrow and limited quantity? But whether fancy is not boundleſs.

308. Whether this capricious tyrant, which uſurps the place of reaſon, doth not moſt cruelly torment and delude thoſe poor men, the uſurers, ſtock-jobbers and projectors, of content to themſelves from heaping up riches, that is, from gathering counters, from multiplying figures, from

enlarging denominations, without knowing what they would be at, and without having a proper regard to the uſe, or end, or nature of things?

309. Whether the *ignis fatuus* of fancy doth not kindle immoderate deſires, and lead men into endleſs purſuits and wild labyrinths?

310. Whether counters be not referred to other things, which ſo long as they keep pace and proportion with the counters, it muſt be owned the counters are uſeful, but whether beyond that to value or covet counters, be not direct folly?

311. Whether the public aim ought not to be that men's induſtry ſhould ſupply their preſent wants, and the overplus be converted into a ſtock of power?

312. Whether the better this power is ſecured, and the more eaſily it is transferred, induſtry be not ſo much the more encouraged?

313. Whether money, more than is expedient for thoſe purpoſes, be not upon the whole hurtful, rather than beneficial to a ſtate?

314. Whether the promoting of induſtry ſhould not be always in view, as the true and ſole end, the rule and meaſure of a national bank? And whether all deviations from that object ſhould not be carefully avoided?

315. Whether it may not be uſeful, for ſupplying manufactures and trade with ſtock, for regulating exchange, for quickening commerce, for putting ſpirit into the people?

316. Whether we are ſufficiently ſenſible of the peculiar ſecurity there is in having a bank, that conſiſts of land and paper, one of which cannot be exported, and the other is in no danger of being exported?

317. Whether it be not delightful to complain? And whether there be not many who had rather utter their complaints than redreſs their evils?

318. Whether,

318. Whether, if *the crown of the wiſe be their riches*, * we are not the fooliſheſt people in Chriſtendom?

319. Whether we have not all the while great civil as well as natural advantages?

320. Whether there be any people, who have more leiſure to cultivate the arts of peace, and ſtudy the public weal?

321. Whether other nations who enjoy any ſhare of freedom, and have great objects in view, be not unavoidably embarraſſed and diſtracted by factions? But whether we do not divide upon trifles, and whether our parties are not a burleſque upon politics?

322. Whether it be not an advantage that we are not embroiled in foreign affairs, that we hold not the balance of *Europe*, that we are protected by other fleets and armies, that it is the true intereſt of a powerful people, from whom we are deſcended, to guard us on all ſides?

323. Whether *England* doth not really love us and wiſh well to us, as *bone* of her *bone*, and *fleſh* of her *fleſh?* And whether it be not our part, to cultivate this love and affection all manner of ways?

324. What ſea-ports or foreign trade have the *Swiſſes*; and yet how warm are thoſe people and how well provided?

325. Whether there may not be found a people who ſo contrive as to be impoveriſhed by their trade? And whether we are not that people?

326. Whether it would not be better for this iſland, if all our fine folk of both ſexes were ſhipped off, to remain in foreign countries, rather than that they ſhould ſpend their eſtates at home in foreign luxury, and ſpread the contagion thereof through their native land?

327. Whether our gentry underſtand or have a notion of magnifi-

* Prov. xiv. 24.

cence, and whether for want thereof, they do not affect very wretched diſtinctions?

328. Whether there be not an art or ſkill in governing human pride, ſo as to render it ſubſervient to the public aim?

329. Whether the great and general aim of the public ſhould not be to employ the people?

330. What right an eldeſt ſon hath to the worſt education?

331. Whether men's counſels are not the reſult of their knowledge and their principles?

332. Whether there be not labour of the brains as well as of the hands, and whether the former is beneath a gentleman?

333. Whether the public be more intereſted, to protect the property acquired by mere birth, than that which is the immediate fruit of learning and virtue?

334. Whether it would not be a poor and ill-judged project to attempt to promote the good of the community, by invading the rights of one part thereof, or of one particular order of men?

335. Whether there be a more wretched, and at the ſame time a more unpitied caſe, than for men to make precedents for their own undoing?

336. Whether to determine about the rights and properties of men by other rules than the law, be not dangerous?

337. Whether thoſe men, who move the corner-ſtones of a conſtitution, may not pull an old houſe on their own heads?

338. Whether there be not two general methods whereby men become ſharers in the national ſtock of wealth or power, induſtry and inheritance?

And

And whether it would be wiſe in a civil ſociety to leſſen that ſhare which is allotted to merit and induſtry?

339. Whether all ways of ſpending a fortune be of equal benefit to the public, and what ſort of men are apteſt to run into an improper expence?

340. If the revenues allotted for the encouragement of religion and learning were made hereditary in the hands of a dozen lay-lords and as many overgrown commoners, whether the public would be much the better for it?

341. Whether the church's patrimony belongs to one tribe alone; and whether every man's ſon, brother, or himſelf may not, if he pleaſe, be qualified to ſhare therein?

342. What is there in the clergy to create a jealouſy in the public? Or what would the public loſe by it, if every 'ſquire in the land wore a black coat, ſaid his prayers, and was obliged to reſide?

343. Whether there be any thing perfect under the ſun? And, whether it be not with the world as with a particular ſtate, and with a ſtate or body-politic as with the human body, which lives and moves under various indiſpoſitions, perfect health being ſeldom or never to be found?

344. Whether, nevertheleſs, men ſhould not in all things aim at perfection? And, therefore, whether any wiſe and good man would be againſt applying remedies? But whether it is not natural to wiſh for a benevolent phyſician?

345. Whether the public happineſs be not propoſed by the legiſlature, and whether ſuch happineſs doth not contain that of the individuals?

346. Whether, therefore, a legiſlator ſhould be content with a vulgar ſhare of knowledge? Whether he ſhould not be a perſon of reflection and

and thought, who hath made it his ſtudy to underſtand the true nature and intereſt of mankind, how to guide men's humours and paſſions, how to incite their active powers, how to make their ſeveral talents co-operate to the mutual benefit of each other, and the general good of the whole?

347. Whether it doth not follow, that above all things a gentleman's care ſhould be to keep his own faculties ſound and entire?

348. Whether the natural phlegm of this iſland needs any additional ſtupifier?

349. Whether all ſpirituous liquors are not, in truth, opiates?

350. Whether our men of buſineſs are not generally very grave by fifty?

351. Whether all men have not faculties of mind or body, which may be employed for the public benefit?

352. Whether the main point be not to multiply and employ our people?

353. Whether hearty food and warm clothing would not enable and encourage the lower ſort to labour?

354. Whether in ſuch a ſoil as ours, if there was induſtry, there could be want?

355. Whether the way to make men induſtrious, be not to let them taſte the fruits of their induſtry? And whether the labouring ox ſhould be muzzled?

356. Whether our landlords are to be told, that induſtry and numbers would raiſe the value of their lands, or that one acre about the Tholſel is worth ten thouſand acres in *Connaught?*

357. Whether

357. Whether our old native *Iriſh* are not the moſt indolent and ſupine people in *Chriſtendom?*

358. Whether they are yet civilized, and whether their habitations and furniture are not more ſordid than thoſe of the ſavage *Americans?*

359. Whether it be not a ſad circumſtance to live among lazy beggars? And whether, on the other hand, it would not be delightful to live in a country ſwarming, like *China*, with buſy people?

360. Whether we ſhould not caſt about, by all manner of means, to excite induſtry, and to remove whatever hinders it? And whether every one ſhould not lend an helping hand?

361. Whether vanity itſelf ſhould not be engaged in this good work? And whether it is not to be wiſhed, that the finding of employment for themſelves and others, were a faſhionable diſtinction among the ladies?

362. Whether idleneſs be the mother or the daughter of ſpleen?

363. Whether it may not be worth while to publiſh the converſation of *Iſchomachus* and his wife in *Xenophon*, for the uſe of our ladies?

364 Whether it is true, that there have been, upon a time, one hundred millions of people employed in *China*, without the woollen-trade, or any foreign commerce?

365. Whether the natural inducements to ſloth are not greater in the mogul's country than in *Ireland*, and yet whether in that ſuffocating and diſpiriting climate, the *Banyans* are not all, men, women, and children, conſtantly employed?

366. Whether it be not true, that the great mogul's ſubjects might underſell us even in our own markets, and clothe our people with their ſtuffs and calicoes, if they were imported duty-free?

367. Whether

367. Whether there can be a greater reproach on the leading men and the patriots of a country, than that the people ſhould want employment? And whether methods may not be found to employ even the lame and the blind, the dumb, the deaf, and the maimed, in ſome or other branch of our manufactures?

368. Whether much may not be expected from a biennial conſultation of ſo many wiſe men about the public good?

369. Whether a tax upon dirt would not be one way of encouraging induſtry?

370. Whether it would be a great hardſhip, if every pariſh were obliged to find work for their poor?

371. Whether children eſpecially, ſhould not be inured to labour betimes?

372. Whether there ſhould not be erected, in each province, an hoſpital for orphans and foundlings at the expence of old bachelors?

373. Whether it be true, that in the *Dutch* work-houſes, things are ſo managed, that a child four years old, may earn its own livelihood?

374. What a folly is it to build fine houſes, or eſtabliſh lucrative poſts and large incomes, under the notion of providing for the poor?

375. Whether the poor grown up and in health need any other proviſion, but their own induſtry under public inſpection?

376. Whether the poor-tax in *England* hath leſſened, or increaſed the number of the poor?

377. Whether work-houſes ſhould not be made at the leaſt expence, with clay-floors and walls of rough ſtone, without plaiſtering, cieling, or glazing.

378. Whether

378. Whether it be an impoſſible attempt to ſet our people at work, or whether induſtry be a habit which like other habits, may by time and ſkill be introduced among any people?

379. Whether all manner of means ſhould not be employed to poſſeſs the nation in general, with an averſion and contempt for idleneſs and all idle folk?

380. Whether it would be a hardſhip on people deſtitute of all things, if the public furniſhed them with neceſſaries which they ſhould be obliged to earn by their labour?

381. Whether other nations have not found great benefit from the uſe of ſlaves in repairing high roads, making rivers navigable, draining bogs, erecting public buildings, bridges and manufactures?

382. Whether temporary ſervitude would not be the beſt cure for idleneſs and beggary?

383. Whether the public hath not a right to employ thoſe who cannot, or who will not find employment for themſelves?

384. Whether all ſturdy beggars ſhould not be ſeized and made ſlaves to the public, for a certain term of years?

385. Whether he who is chained in a jail or dungeon, hath not, for the time, loſt his liberty? And if ſo, whether temporary ſlavery be not already admitted among us?

386. Whether a ſtate of ſervitude, wherein he ſhould be well worked, fed and cloathed, would not be a preferment to ſuch a fellow?

387. Whether criminals in the freeſt country may not forfeit their liberty, and repair the damage they have done the public, by hard labour?

388. What the word ſervant ſignifies in the New-Teſtament?

389. Whether the view of criminals chained in pairs and kept at hard labour, would not be very edifying to the multitude?

390. Whether the want of ſuch an inſtitution be not plainly ſeen in *England*, where the diſbelief of a future ſtate hardeneth rogues againſt the fear of death, and where, through the great growth of robbers and houſe-breakers it becomes every day more neceſſary?

391. Whether it be not eaſier to prevent than to remedy, and whether we ſhould not profit by the example of others?

392. Whether felons are not often ſpared, and therefore encouraged, by the compaſſion of thoſe who ſhould proſecute them?

393. Whether many that would not take away the life of a thief, may not nevertheleſs be willing to bring him to a more adequate puniſhment?

394. Whether the moſt indolent would be fond of idleneſs, if they regarded it as the ſure road to hard labour?

395. Whether the induſtry of the lower part of our people doth not much depend on the expence of the upper?

396. What would be the conſequence, if our gentry affected to diſtinguiſh themſelves by fine houſes rather than fine clothes?

397. Whether any people in *Europe* are ſo meanly provided with houſes and furniture in proportion to their incomes, as the men of eſtates in *Ireland?*

398. Whether building would not peculiarly encourage all other arts in this kingdom?

399. Whether ſmiths, maſons, bricklayers, plaiſterers, carpenters, joiners,

ers, tilers, plumbers and glaziers, would not all find employment if the humour of building prevailed?

400. Whether the ornaments and furniture of a good houſe do not employ a number of all ſorts of artificers, in iron, wood, marble, braſs, pewter, copper, wool, flax, and divers other materials?

401. Whether in buildings and gardens, a great number of day-labourers do not find employment?

402. Whether by theſe means much of that ſuſtenance and wealth of this nation which now goes to foreigners would not be kept at home, and nouriſh and circulate among our own people?

403. Whether as induſtry produced good living, the number of hands and mouths would not be increaſed; and in proportion thereunto, whether there would not be every day more occaſion for agriculture? And whether this article alone would not employ a world of people?

404. Whether ſuch management would not equally provide for the magnificence of the rich, and the neceſſities of the poor?

405. Whether an expence in building and improvements doth not remain at home, paſs to the heir, and adorn the public? And whether any of theſe things can be ſaid of claret?

406. Whether fools do not make faſhions, and wiſe men follow them?

407. Whether, for one who hurts his fortune by improvements, twenty do not ruin themſelves by foreign luxury?

408. Whether in proportion as *Ireland* was improved and beautified by fine ſeats, the number of abſentees would not decreaſe?

409. Whether he who employs men in buildings and manufactures

doth not put life in the country, and whether the neighbourhood round him be not obſerved to thrive?

410. Whether money circulated on the landlords own lands, and among his own tenants, doth not return into his own pocket?

411. Whether every 'ſquire that made his domain ſwarm with buſy hands, like a bee-hive or ant-hill, would not ſerve his own intereſt, as well as that of his country?

412. Whether a gentleman, who hath ſeen a little of the world and obſerved how men live elſewhere, can contentedly ſit down in a cold, damp, ſordid habitation, in the midſt of a bleak country, inhabited by thieves and beggars?

413. Whether on the other hand, a handſome ſeat amidſt well-improved lands, fair villages, and a thriving neighbourhood, may not invite a man to dwell on his own eſtate, and quit the life of an inſignificant ſaunterer about town, for that of an uſeful country-gentleman?

414. Whether it would not be of uſe and ornament, if the towns throughout this kingdom were provided with decent churches, town-houſes, work-houſes, market-places and paved ſtreets, with ſome order taken for cleanlineſs?

415. Whether if each of theſe towns were addicted to ſome peculiar manufacture, we ſhould not find, that the employing many hands together on the ſame work was the way to perfect our workmen? And whether all theſe things might not ſoon be provided by a domeſtic induſtry, if money were not wanting?

416. Whether money could ever be wanting to the demands of induſtry, if we had a national bank?

417. Whether

417. Whether the fable of *Hercules* and the carter, ever ſuited any nation like this nation of *Ireland?*

418. Whether it be not a new ſpectacle under the ſun, to behold in ſuch a climate and ſuch a ſoil, and under ſuch a gentle government, ſo many roads untrodden, fields untilled, houſes deſolate and hands unemployed?

419. Whether there is any country in Chriſtendom, either kingdom or republic, depending or independent, free or enſlaved, which may not afford us an uſeful leſſon?

420. Whether the frugal *Swiſſes* have any other commodities, but their butter and cheeſe and a few cattle, for exportation; whether, nevertheleſs, the ſingle canton of *Bearn* hath not in her public treaſury two millions ſterling?

421. Whether that ſmall town of *Bearn*, with its ſcanty, barren territory, in a mountainous corner, without ſea-ports, without manufactures, without mines, be not rich by mere dint of frugality?

422. Whether the *Swiſſes* in general have not ſumptuary laws, prohibiting the uſe of gold, jewels, ſilver, ſilk, and lace in their apparel, and indulging the women only to wear ſilk on feſtivals, weddings, and public ſolemnities?

423. Whether there be not two ways of growing rich, ſparing and getting? But whether the lazy ſpendthrift muſt not be doubly poor?

424. Whether money circulating be not the life of induſtry; and whether the want thereof doth not render a ſtate gouty and inactive?

425. But, whether if we had a national bank, and our preſent caſh (ſmall as it is) were put into the moſt convenient ſhape, men ſhould hear any public complaints for want of money?

426. Whether

426. Whether all circulation be not alike a circulation of credit, whatſoever medium (metal or paper) is employed, and whether gold be any more than credit for ſo much power?

427. Whether the wealth of the richeſt nations in Chriſtendom doth not conſiſt in paper, vaſtly more than in gold and ſilver?

428. Whether Lord *Clarendon* doth not aver of his own knowledge, that the prince of *Orange*, with the beſt credit, and the aſſiſtance of the richeſt men in *Amſterdam*, was above ten days endeavouring to raiſe twenty thouſand pounds in ſpecie, without being able to raiſe half the ſum in all that time? *See* Clarendon's *Hiſtory*, B. 12.

429. Suppoſing there had been hitherto no ſuch thing as a bank, and the queſtion were now firſt propoſed, whether it would be ſafer to circulate unlimited bills in a private credit, or bills to a limited value on the public credit of the community, what would men think?

430. Whether the maxim, *What is every body's buſineſs is no body's*, prevails in any country under the ſun more than in *Ireland?*

431. Whether the united ſtock of a nation be not the beſt ſecurity? And whether any thing but the ruin of the ſtate can produce a national bankruptcy?

432. Whether the total ſum of the public treaſure, power and wiſdom, all co-operating, be not moſt likely to eſtabliſh a bank of credit, ſufficient to anſwer the ends, relieve the wants and ſatisfy the ſcruples of all people?

433. Whether *London* is not to be conſidered as the metropolis of *Ireland?* And whether our wealth (ſuch as it is) doth not circulate through *London*, and throughout all *England*, as freely as that of any part of his majeſty's dominions?

434. Whether

434. Whether therefore it be not evidently the intereſt of the people of *England*, to encourage rather than to oppoſe a national bank in this kingdom, as well as every other means for advancing our wealth, which ſhall not impair their own?

435. Whether it is not our intereſt to be uſeful to them rather than rival them; and whether in that caſe we may not be ſure of their good offices?

436. Whether we can propoſe to thrive, ſo long as we entertain a wrongheaded diſtruſt of *England?*

437. Whether, as a national bank would increaſe our induſtry and that our wealth, *England* may not be a proportionable gainer; and whether we ſhould not conſider the gains of our mother-country as ſome acceſſion to our own?

438. Whether there be any difficulty in comprehending, that the whole wealth of the nation is in truth the ſtock of a national bank? And whether any more than the right comprehenſion of this, be neceſſary to make all men eaſy with regard to its credit?

439. Whether the prejudices about gold and ſilver are not ſtrong, but whether they are not ſtill prejudices?

440. Whether paper doth not by its ſtamp and ſignature acquire a local value, and become as precious and as ſcarce as gold? And whether it be not much fitter to circulate large ſums, and therefore preferable to gold?

441. Whether it doth not much import to have a right conception of money? And whether its true and juſt idea be not that of a ticket, entitling to power and fitted to record and transfer ſuch power?

442. Though

442. Though the bank of *Amſterdam* doth very rarely, if at all, pay out money, yet whether every man poſſeſſed of ſpecie be not ready to convert it into paper, and act as caſhier to the bank? And whether, from the ſame motive, every monied man throughout this kingdom, would not be caſhier to our national bank?

443. Whether we may not obtain that as friends, which it is in vain to hope for as rivals?

444. Whether in every inſtance by which we prejudice *Eugland*, we do not in a greater degree prejudice ourſelves?

445. Whether in the rude original of ſociety, the firſt ſtep was not the exchanging of commodities, the next a ſubſtituting of metals by weight as the common medium of circulation, after this the making uſe of coin, laſtly a further refinement by the uſe of paper with proper marks and ſignatures? And whether this, as it is the laſt, ſo it be not the greateſt improvement?

446. Whether we are not in fact the only people, who may be ſaid to ſtarve in the midſt of plenty?

447. Whether there can be a worſe ſign than that people ſhould quit their country for a livelihood? Though men often leave their country for health, or pleaſure, or riches, yet to leave it merely for a livelihood? Whether this be not exceeding bad, and ſheweth ſome peculiar miſmanagement?

448. Whether in order to redreſs our evils, artificial helps are not moſt wanted, in a land where induſtry is moſt againſt the natural grain of the people?

449. Whether, although the prepoſſeſſions about gold and ſilver have taken deep root, yet the example of our colonies in *America* doth not make

make it as plain as day-light, that they are not ſo neceſſary to the wealth of a nation, as the vulgar of all ranks imagine?

450. Whether it be not evident that we may maintain a much greater inward and outward commerce, and be five times riches than we are, nay, and our bills abroad be of far greater credit, though we had not one ounce of gold or ſilver in the whole iſland?

451. Whether wrongheaded maxims, cuſtoms and faſhions, are not ſufficient to deſtroy any people which hath ſo few reſources as the inhabitants of *Ireland?*

452. Whether it would not be an horrible thing, to ſee our matrons make dreſs and play their chief concern?

453 Whether our ladies might not as well endow monaſteries as wear *Flanders* lace? And whether it be not true that popiſh nuns are maintained by proteſtant contributions?

454. Whether *England*, which hath a free trade, whatever ſhe remits for foreign luxury with one hand, doth not with the other receive much more from abroad? Whether, nevertheleſs, this nation would not be a gainer, if our women would content themſelves, with the ſame moderation in point of expence, as the *Engliſh* ladies?

455. But whether it be not a notorious truth, that our *Iriſh* ladies are on a foot, as to dreſs, with thoſe of five times their fortune in *England?*

456. Whether it be not even certain, that the matrons of this forlorn country ſend out a greater proportion of its wealth, for fine apparel, than any other females on the whole ſurface of this terraqueous globe?

457. Whether the expence, great as it is, be the greateſt evil; but whether this folly may not produce many other follies, an entire derange-

ment of domeſtic life, abſurd manners, neglect of duties, bad mothers, a general corruption in both ſexes?

458. Whether the firſt beginning of expedients do not always meet with prejudices? And whether even the prejudices of a people ought not to be reſpected?

459. Whether a national bank be not the true philoſopher's ſtone in a ſtate?

460. Whether all regulations of coin ſhould not be made, with a view to encourage induſtry and a circulation of commerce, throughout the kingdom?

461. Whether to oil the wheels of commerce, be not a common benefit? And whether this be not done by avoiding fractions and multiplying ſmall ſilver?

462. Whether, all things conſidered, a general raiſing the value of gold and ſilver be not ſo far from bringing greater quantities thereof into the kingdom, that it would produce a direct contrary effect, inaſmuch as leſs, in that caſe, would ſerve, and therefore leſs be wanted? And whether men do not import a commodity, in proportion to the demand or want of it?

463. Whether the lowering of our gold would not create a fever in the ſtate? And whether a fever be not ſometimes a cure, but whether it be not the laſt cure a man would chooſe?

464. Whether raiſing the value of a particular ſpecies will not tend to multiply ſuch ſpecies, and to leſſen others in proportion thereunto? And whether a much leſs quantity of caſh in ſilver would not, in reality, enrich the nation more than a much greater in gold?

465. Whether,

465. Whether, *cæteris paribus*, it be not true that the prices of things increaſe, as the quantity of money increaſeth, and are diminiſhed as that is diminiſhed? And whether, by the quantity of money, is not to be underſtood the amount of the denominations, all contracts being nominal for pounds, ſhillings and pence, and not for weights of gold or ſilver?

466. Whether our exports do not conſiſt of ſuch neceſſaries as other countries cannot well be without?

467. Whether upon the circulation of a national bank more land would not be tilled, more hands employed, and conſequently more commodities exported?

468. Whether ſilver and ſmall money be not that which circulates the quickeſt, and paſſeth through all hands, on the road, in the market, at the ſhop?

469. Whether, all things conſidered, it would not be better for a kingdom that its caſh conſiſted of half a million in ſmall ſilver, than of five times that ſum in gold?

470. Whether there be not every day five hundred leſſer payments made for one that requires gold?

471. Whether *Spain*, where gold bears the higheſt value, be not the lazieſt, and *China*, where it bears the loweſt, be not the moſt induſtrious country in the known world?

472. Whether it be not evidently the intereſt of every ſtate, that its money ſhould rather circulate than ſtagnate?

473. Whether the principal uſe of caſh be not its ready paſſing from hand to hand, to anſwer common occaſions of the common people, and whether common occaſions of all ſorts of people are not ſmall ones?

474. Whether buſineſs at fairs and markets is not often at a ſtand and often hindered, even though the ſeller hath his commodities at hand, and the purchaſer his gold, yet for want of change?

475. As wealth is really power, and coin a ticket conveying power, whether thoſe tickets which are the fitteſt for that uſe, ought not to be preferred?

476. Whether thoſe tickets which ſingly transfer ſmall ſhares of power, and being multiplied, large ſhares, are not fitter for common uſe than thoſe which ſingly transfer large ſhares?

477. Whether the public is not more benefited, by a ſhilling that circulates, than a pound that lies dead?

478. Whether ſixpence twice paid, be not as good as a ſhilling once paid?

479. Whether the ſame ſhilling circulating in a village may not ſupply one man with bread, another with ſtockings, a third with a knife, a fourth with paper, a fifth with nails, and ſo anſwer many wants which muſt otherwiſe have remained unſatisfied?

480. Whether facilitating and quickening the circulation of power to ſupply wants, be not the promoting of wealth and induſtry among the lower people? And whether upon this the wealth of the great doth not depend?

481. Whether, without the proper means of circulation, it be not vain, to hope for thriving manufactures and a buſy people?

482. Whether four pounds in ſmall caſh may not circulate and enliven an *Iriſh* market, which many four-pound pieces would permit to ſtagnate?*

* In the year 1735, this country abounded with the large gold-coins of *Portugal*, which being over-rated, flowed in from all parts. But that evil is ſince remedied.

483. Whether

483. Whether a man that could move nothing leſs than an hundred pound weight would not be much at a loſs to ſupply his wants; and whether it would not be better for him to be leſs ſtrong and more active?

484. Whether the natural body can be in a ſtate of health and vigour, without a due circulation of the extremities, even in the fingers and toes? And whether the political body, any more than the natural, can thrive without a proportionable circulation through the minuteſt and moſt inconſiderable parts thereof?

485. If we had a mint for coining only ſhillings, ſixpences and copper-money, whether the nation would not ſoon feel the good effects thereof?

486. Whether the greater waſte by wearing of ſmall coins would not be abundantly overbalanced by their uſefulneſs?

487. Whether it be not the induſtry of common people that feeds the ſtate, and whether it be poſſible to keep this induſtry alive without ſmall money?

488. Whether the want of this be not a great bar to our employing the people in theſe manufactures which are open to us, and do not interfere with *Great-Britain?*

489. Whether therefore ſuch want doth not drive men into the lazy way of employing land under ſheep-walk?

490. Whether the running of wool from *Ireland* can ſo effectually be prevented, as by encouraging other buſineſs and manufactures among our people?

491. Whatever commodities *Great-Britain* importeth, which we might ſupply, whether it be not her real intereſt to import them from us rather than from any other people?

492. Whether

492. Whether the apprehenſion of many among us (who for that very reaſon ſtick to their wool) that *England* may hereafter prohibit, limit, or diſcourage our linen trade, when it hath been once, with great pains and expence thoroughly introduced and ſettled in this land, be not altogether groundleſs and unjuſt?

493. Whether it is poſſible for this country, which hath neither mines of gold, nor a free trade, to ſupport, for any time, the ſending out of ſpecie?

494. Whether in fact our payments are not made by bills? And whether our foreign credit doth not depend on our domeſtic induſtry, and our bills on that credit?

495. Whether, in order to mend it, we ought not firſt to know the peculiar wretchedneſs of our ſtate? And whether there be any knowing of this but by compariſon?

496. Whether there are not ſingle market-towns in *England*, that turn more money in buying and ſelling, than whole countries (perhaps provinces) with us?

497. Whether the ſmall town of *Birmingham* alone doth not, upon an average, circulate every week one way or other, to the value of fifty thouſand pounds? But whether the ſame crown may not be often paid?

498. Whether any kingdom in *Europe* be ſo good a cuſtomer at *Bourdeaux* as *Ireland?*

499. Whether the police and œconomy of *France* be not governed by wiſe councils? And whether any one from this country, who ſees their towns, and manufactures, and commerce, will not wonder what our ſenators have been doing?

500. What

500. What variety and number of excellent manufactures are to be met with throughout the whole kingdom of *France?*

501. Whether there are not every where ſome or other mills for many uſes, forges and furnaces for iron-work, looms for tapeſtry, glaſs-houſes, and ſo forth.

502. What quantities of paper, ſtockings, hats, what manufactures of wool, ſilk, linen, hemp, leather, wax, earthern-ware, braſs, lead, tin, *&c.*

503. Whether the manufactures and commerce of the ſingle town of *Lyons* do not amount to a greater value, than all the manufactures and all the trade of this kingdom taken together?

504. Whether in the anniverſary fair at the ſmall town of *Beaucair* upon the *Rhone*, there be not as much money laid out as the current caſh of this kingdom amounts to?

505. Whether the very ſhreds ſhorn from woollen-cloth, which are thrown away in *Ireland*, do not make a beautiful tapeſtry in *France?*

506. Whether there be not *French* towns ſubſiſted merely by making pins?

507. Whether the coarſe fingers of thoſe very women, thoſe ſame peaſants, who one part of the year till the ground and dreſs the vineyards, are not another employed in making the fineſt *French* point?

508. Whether there is not a great number of idle fingers among the wives and daughters of our peaſants?

509. Whether the *French* do not raiſe a trade from ſaffron, dying drugs and the like products, which may do with us as well as with them?

510. Whether

510. Whether we may not have materials of our own growth to ſupply all manufactures, as well as *France*, except ſilk, and whether the bulk of what ſilk, even *France* manufactures, be not imported?

511. Whether it be poſſible for this country to grow rich, ſo long as what is made by domeſtic induſtry, is ſpent in foreign luxury?

512. Whether our natural *Iriſh* are not partly *Spaniards*, and partly *Tartars*; and whether they do not bear ſignatures of their deſcent from both theſe nations, which is alſo confirmed by all their hiſtories?

513. Whether the *Tartar* progeny is not numerous in this land? And whether there is an idler occupation under the ſun than to attend flocks and herds of cattle?

514. Whether the wiſdom of the ſtate ſhould not wreſtle with this hereditary diſpoſition of our *Tartars*, and with a high hand introduce agriculture?

515. Whether once upon a time *France* did not, by her linen alone, draw yearly from *Spain* about eight millions of livres?

516. Whether the *French* have not ſuffered in their linen-trade with *Spain*, by not making their cloth of due breadth; and whether any other people have ſuffered, and are ſtill likely to ſuffer through the ſame prevarication? *

517. Whether the *Spaniards* are not rich and lazy, and whether they have not a particular inclination and favour for the inhabitants of this iſland? But whether a punctual people do not love punctual dealers?

518. Whether about fourteen years ago we had not come into a conſiderable ſhare of the linen-trade with *Spain*, and what put a ſtop to this?

* Things, we hear, are in a way of being mended with us in this reſpect.

519 Whether

519. Whether if the linen-manufacture were carried on in the other provinces, as well as in the north, the merchants of *Cork*, *Limerick*, and *Galway*, would not ſoon find the way to *Spain?*

520. Whether the woollen-manufacture of *England* is not divided into ſeveral parts or branches, appropriated to particular places, where they are only, or principally manufactured; fine cloths in *Somerſetſhire*, coarſe in *Yorkſhire*, long ells at *Exeter*, ſaies at *Sudbury*, crapes at *Norwich*, linſeys at *Kendal*, blankets at *Whitney*, and ſo forth?

521. Whether the united ſkill, induſtry and emulation of many together on the ſame work, be not the way to advance it? And whether it had been otherwiſe poſſible for *England*, to have carried on her woollen-manufacture to ſo great perfection?

522. Whether it would not on many accounts be right, if we obſerved the ſame courſe with reſpect to our linen-manufacture; and that diapers were made in one town or diſtrict, damaſks in another, ſheeting in a third, fine wearing linen in a fourth, coarſe in a fifth, in another cambricks, in another thread and ſtockings, in others ſtamped linen, or ſtriped linen, or tickings, or dyed linen, of which laſt kinds there is ſo great a conſumption among the ſea-faring men of all nations?

523. Whether it may not be worth while, to inform ourſelves of the different ſorts of linen, which are in requeſt among different people?

524. Whether we do not yearly conſume of *French* wines about a thouſand tun more than either *Sweden* or *Denmark*, and yet, whether thoſe nations pay ready money as we do?

525. Whether it be not a cuſtom for ſome thouſands of *Frenchmen* to go about the beginning of *March* into *Spain*, and having tilled the lands and gathered the harveſt of *Spain*, to return home with money in their pockets, about the end of *November?*

526. Whether of late years our *Iriſh* labourers do not carry on the ſame buſineſs in *England*, to the great diſcontent of many there? But whether we have not much more reaſon than the people of *England* to be diſpleaſed at this commerce?

527. Whether, notwithſtanding the caſh ſuppoſed to be brought into it, any nation is, in truth, a gainer by ſuch traffic?

528. Whether the induſtry of our people employed in foreign land, while our own are left uncultivated, be not a great loſs to the country?

529. Whether it would not be much better for us, if, inſtead of ſending our men abroad, we could draw men from the neighbouring countries to cultivate our own?

530. Whether, nevertheleſs, we are not apt to think the money imported by our labourers to be ſo much clear gains to this country; but whether a little reflection and a little political arithmetic, may not ſhew us our miſtake?

531. Whether our prejudices about gold and ſilver are not very apt to infect or miſguide our judgments and reaſonings about the public weal?

532. Whether it be not a good rule whereby to judge of the trade of any city, and its uſefulneſs, to obſerve whether there is a circulation through the extremities, and whether the people round about are buſy and warm?

533. Whether we had not, ſome years ſince, a manufacture of hats at *Athlone*, and of earthen-ware at *Arklow*, and what became of thoſe manufactures?

534. Why do we not make tiles of our own, for flooring and roofing, rather than bring them from *Holland*?

535. What

535. What manufactures are there in *France* and *Venice* of gilt-leather, how cheap and how ſplendid a furniture?

536. Whether we may not for the ſame uſe, manufacture divers things at home, of more beauty and variety than wainſcot, which is imported at ſuch expence from *Norway?*

537. Whether the uſe and the faſhion will not ſoon make a manufacture?

538. Whether if our gentry uſed to drink mead and cyder, we ſhould not ſoon have thoſe liquors in the utmoſt perfection and plenty?

539. Whether it be not wonderful, that with ſuch paſtures, and ſo many black cattle, we do not find ourſelves in cheeſe?

540. Whether great profits may not be made by fiſheries; but whether thoſe of our *Iriſh* who live by that buſineſs, do not contrive to be drunk and unemployed, one half of the year?

541. Whether it be not folly to think, an inward commerce cannot enrich a ſtate, becauſe it doth not encreaſe its quantity of gold and ſilver? And whether it is poſſible a country ſhould not thrive, while wants are ſupplied, and buſineſs goes on?

542. Whether plenty of all the neceſſaries and comforts of life be not real wealth?

543. Whether *Lyons*, by the advantage of her midland ſituation and the rivers *Rhone* and *Sone*, be not a great magazine, or mart for inward commerce? And whether ſhe doth not maintain a conſtant trade with moſt parts of *France*; with *Provence* for oils and dried fruits, for wines and cloth with *Languedoc*, for ſtuffs with *Champaign*, for linen with *Picardy*, *Normandy* and *Bretagne*, for corn with *Burgundy?*

544. Whether ſhe doth not receive and utter all thoſe commodities, and raiſe a profit from the diſtribution thereof, as well as of her own manufactures, throughout the kingdom of *France*?

545. Whether the charge, of making good roads and navigable rivers acroſs the country, would not be really repaid by an inward commerce?

546. Whether as our trade and manufactures increaſed, magazines ſhould not be eſtabliſhed in proper places, fitted by their ſituation, near great roads and navigable rivers, lakes or canals, for the ready reception and diſtribution of all ſorts of commodities, from and to the ſeveral parts of the kingdom; and whether the town of *Athlone*, for inſtance, may not be fitly ſituated for ſuch a magazine, or centre of domeſtic commerce?

547. Whether an inward trade would not cauſe induſtry to flouriſh, and multiply the circulation of our coin, and whether this may not do as well as multiplying the coin itſelf?

548. Whether the benefits of a domeſtic commerce are ſufficiently underſtood and attended to, and whether the cauſe thereof be not the prejudiced and narrow way of thinking about gold and ſilver?

549. Whether there be any other more eaſy and unenvied method of increaſing the wealth of a people?

550. Whether we of this iſland are not from our peculiar circumſtances determined to this very commerce above any other, from the number of neceſſaries and good things that we poſſeſs within ourſelves, from the extent and variety of our ſoil, from the navigable rivers and good roads which we have or may have, at a leſs expence than any people in *Europe*, from our great plenty of materials for manufactures, and particularly from the reſtraints we lie under with regard to our foreign trade?

551. Whether

551. Whether annual inventories ſhould not be publiſhed of the fairs throughout the kingdom, in order to judge of the growth of its commerce?

552. Whether there be not every year more caſh circulated at the card-tables of *Dublin*, than at all the fairs of *Ireland?*

553. Whether the wealth of a country will not bear proportion to the ſkill and induſtry of its inhabitants?

554. Whether foreign imports that tend to promote induſtry ſhould not be encouraged, and ſuch as have a tendency to promote luxury ſhould not be diſcouraged?

555. Whether the annual balance of trade between *Italy* and *Lyons* be not about four millions in favour of the former, and yet, whether *Lyons* be not a gainer by this trade?

556. Whether the general rule, of determining the profit of a commerce by its balance, doth not, like other general rules, admit of exceptions?

557. Whether it would not be a monſtrous folly to import nothing but gold and ſilver, ſuppoſing we might do it, from every foreign part to which we trade? And yet, whether ſome men may not think this fooliſh circumſtance a very happy one?

558. But whether we do not all ſee the ridicule of the mogul's ſubjects, who take from us nothing but our ſilver, and bury it under ground, in order to make ſure thereof againſt the reſurrection?

559. Whether he muſt not be a wrongheaded patriot or politician, whoſe ultimate view was drawing money into a country, and keeping it there?

560. Whether it be not evident, that not gold but induſtry cauſeth a country to flouriſh?

561. Whether

561. Whether it would not be a ſilly project in any nation, to hope to grow rich by prohibiting the exportation of gold and ſilver?

562. Whether there can be a greater miſtake in politics, than to meaſure the wealth of the nation by its gold and ſilver?

563. Whether gold and ſilver be not a drug, where they do not promote induſtry? Whether they be not even the bane and undoing of an idle people?

564. Whether gold will not cauſe either induſtry or vice to flouriſh? And whether a country, where it flowed in without labour, muſt not be wretched and diſſolute like an iſland inhabited by buccaneers?

565. Whether arts and virtue are not likely to thrive, where money is made a means to induſtry? But whether money without this would be a bleſſing to any people?

566. Whether keeping caſh at home, or ſending it abroad, juſt as it moſt ſerves to promote induſtry, be not the real intereſt of every nation?

567. Whether commodities of all kinds do not naturally flow where there is the greateſt demand? Whether the greateſt demand for a thing be not where it is of moſt uſe? Whether money, like other things, hath not its proper uſe? Whether this uſe be not to circulate? Whether therefore there muſt not of courſe be money where there is a circulation of induſtry?

568. Whether it is not a great point to know what we would be at? And whether whole ſtates, as well as private perſons, do not often fluctuate for want of this knowledge?

569. Whether gold may not be compared to *Sejanus*'s horſe, if we conſider its paſſage through the world, and the fate of thoſe nations which have been ſucceſſively poſſeſſed thereof?

570. Whether

570. Whether means are not ſo far uſeful as they anſwer the end? And whether, in different circumſtances, the ſame ends are not obtained by different means?

571. If we are a poor nation, abounding with very poor people, will it not follow, that a far greater proportion of our ſtock ſhould be in the ſmalleſt and loweſt ſpecies, than would ſuit with *England?*

572. Whether, therefore, it would not be highly expedient, if our money were coined of peculiar values, beſt fitted to the circumſtances and uſes of our own country; and whether any other people could take umbrage at our conſulting our own convenience, in an affair entirely domeſtic, and that lies within ourſelves?

573. Whether every man doth not know, and hath not long known, that the want of a mint cauſeth many other wants in this kingdom?

574. What harm did *England* ſuſtain about three centuries ago, when ſilver was coined in this kingdom?

575. What harm was it to *Spain* that her provinces of *Naples* and *Sicily* had all along mints of their own?

576. Whether it may not be preſumed, that our not having a privilege, which every other kingdom in the world enjoys, be not owing to our own want of diligence and unanimity in ſoliciting for it?

577. Whether it be not the intereſt of *England*, that we ſhould cultivate a domeſtic commerce among ourſelves? And whether it could give them any poſſible jealouſy, if our ſmall ſum of caſh was contrived to go a little further, if there was a little more life in our markets, a little more buying and ſelling in our ſhops, a little better proviſion for the backs and bellies of ſo many forlorn wretches throughout the towns and villages of this iſland?

578. Whether

578. Whether *Great-Britain* ought not to promote the proſperity of her colonies, by all methods conſiſtent with her own? And whether the colonies themſelves ought to wiſh or aim at it by others?

579. Whether the remoteſt parts from the metropolis, and the loweſt of the people, are not to be regarded as the extremities and capillaries of the political body?

580. Whether, although the capillary veſſels are ſmall, yet obſtructions in them do not produce great chronical diſeaſes?

581. Whether faculties are not enlarged and improved by exerciſe?

582. Whether the ſum of the faculties put into act, or in other words, the united action of a whole people doth not conſtitute the *momentum* of a ſtate?

583. Whether ſuch *momentum* be not the real ſtock or wealth of a ſtate; and whether its credit be not proportional thereunto?

584. Whether in every wiſe ſtate the faculties of the mind are not moſt conſidered?

585. Whether the *momentum* of a ſtate doth not imply the whole exertion of its faculties, intellectual and corporeal; and whether the latter without the former, could act in concert?

586. Whether the divided force of men, acting ſingly, would not be a rope of ſand?

587. Whether the particular motions of the members of a ſtate, in oppoſite directions, will not deſtroy each other, and leſſen the *momentum* of the whole; but whether they muſt not conſpire to produce a great effect?

588. Whether the ready means to put ſpirit into this ſtate, to fortify and

and increaſe its *momentum*, would not be a national bank, and plenty of ſmall caſh?

589. Whether that which employs and exerts the force of a community, deſerves not to be well conſidered and well underſtood?

590. Whether the immediate mover, the blood and ſpirits, be not money, paper or metal, and whether the ſoul or will of the community, which is the prime mover that governs and directs the whole, be not the legiſlature?

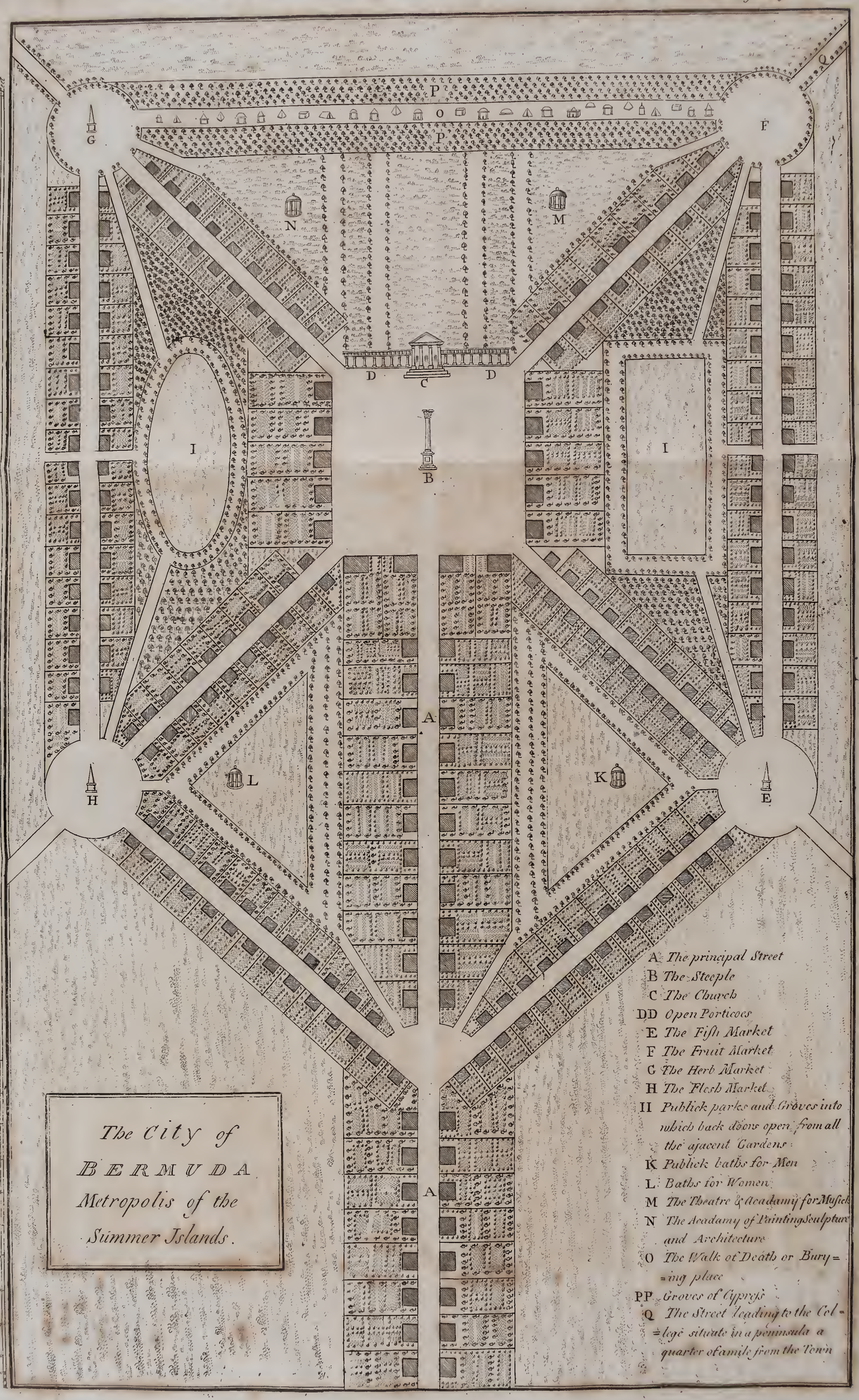
591. Suppoſing the inhabitants of a country quite ſunk in ſloth, or even faſt aſleep, whether upon the gradual awakening and exertion, firſt, of the ſenſitive and locomotive faculties, next of reaſon and reflection, then of juſtice and piety, the *momentum* of ſuch country or ſtate, would not, in proportion thereunto, become ſtill more and more conſiderable?

592. Whether that which in the growth is laſt attained, and is the finiſhing perfection of a people, be not the firſt thing loſt in their declenſion?

593. Whether force be not of conſequence, as it is exerted; and whether great force without great wiſdom may not be a nuiſance?

594. Whether the force of a child applied with art, may not produce greater effects than that of a giant? And whether a ſmall ſtock in the hands of a wiſe ſtate, may not go further, and produce more conſiderable effects, than immenſe ſums in the hands of a fooliſh one?

595. Whoſe fault is it if poor *Ireland* ſtill continues poor?



The City of
BERMUDA
Metropolis of the
Summer Islands.

A *The principal Street*
B *The Steeple*
C *The Church*
DD *Open Porticoes*
E *The Fish Market*
F *The Fruit Market*
G *The Herb Market*
H *The Flesh Market*
II *Publick parks and Groves into which back doors open from all the ajacent Gardens*
K *Publick baths for Men*
L *Baths for Women*
M *The Theatre & Academy for Musick*
N *The Academy of Printing Sculpture and Architecture*
O *The Walk of Death or Burying place*
PP *Groves of Cypress*
Q *The Street leading to the College situate in a peninsula a quarter of a mile from the Town*

A

PROPOSAL

For the better ſupplying of

CHURCHES

IN OUR

FOREIGN PLANTATIONS,

AND FOR

Converting the Savage AMERICANS to CHRISTIANITY,

By a COLLEGE to be erected in the SUMMER ISLANDS, otherwiſe called the Iſles of BERMUDA.

A

PROPOSAL, &c.

ALTHOUGH there are ſeveral excellent perſons of the Church of *England*, whoſe good intentions and endeavours have not been wanting to propagate the goſpel in foreign parts, who have even combined into ſocieties for that very purpoſe, and given great encouragement, not only for *Engliſh* miſſionaries in the *Weſt-Indies*, but alſo, for the reformed of other nations, led by their example, to propagate chriſtianity in the eaſt: it is nevertheleſs acknowledged, that there is at this day, but little ſenſe of religion, and a moſt notorious corruption of manners, in the *Engliſh* colonies ſettled on the continent of *America*, and the iſlands. It is alſo acknowledged, that the goſpel hath hitherto made but a very inconſiderable progreſs among the neighbouring *Americans*, who ſtill continue in much the ſame ignorance and barbariſm, in which we found them above a hundred years ago.

I ſhall therefore venture to ſubmit my thoughts upon a point, that I have long conſidered, to better judgments, in hopes that any expedient will be favourably hearkened to, which is propoſed for the remedy of theſe evils. Now, in order to effect this, it ſhould ſeem the natural proper method, to provide, in the firſt place, a conſtant ſupply of worthy clergymen for the *Engliſh* churches in thoſe parts; and in the ſecond

place,

place, a like conſtant ſupply of zealous miſſionaries, well fitted for propagating chriſtianity among the ſavages.

For though the ſureſt means to reform the morals, and ſoften the behaviour of men, be, to preach to them the pure uncorrupt doctrine of the goſpel, yet it cannot be denied, that the ſucceſs of preaching dependeth in good meaſure on the character and ſkill of the preacher: foraſmuch as mankind are more apt to copy characters than to practiſe precepts, and foraſmuch as argument, to attain its full ſtrength, doth not leſs require the life of zeal, than the weight of reaſon; and the ſame doctrine, which maketh great impreſſion, when delivered with decency and addreſs, loſeth very much of its force by paſſing through aukward or unſkilful hands.

Now the clergy ſent over to *America* have proved, too many of them, very meanly qualified both in learning and morals for the diſcharge of their office. And indeed little can be expected from the example or inſtruction of thoſe, who quit their native country on no other motive, than that they are not able to procure a livelihood in it, which is known to be often the caſe.

To this may be imputed the ſmall care that hath been taken to convert the negroes of our plantations, who, to the infamy of *England*, and ſcandal of the world, continue heathen under chriſtian maſters, and in chriſtian countries. Which could never be, if our planters were rightly inſtructed and made ſenſible, that they diſappointed their own baptiſm by denying it to thoſe who belong to them: that it would be of advantage to their affairs, to have ſlaves who ſhould *obey in all things their maſters according to the fleſh, not with eye-ſervice as men-pleaſers, but, in ſingleneſs of heart as fearing God:* that goſpel liberty conſiſts with temporal

poral ſervitude; and that their ſlaves would only become better ſlaves by being chriſtian.

And though it be allowed that ſome of the clergy in our colonies have approved themſelves men of merit, it will at the ſame time be allowed, that the moſt zealous and able miſſionary from *England* muſt find himſelf but ill qualified for converting the *American* heathen, if we conſider the difference of language, their wild way of living, and above all, the great jealouſy and prejudice which ſavage nations have towards foreigners, or innovations introduced by them.

Theſe conſiderations make it evident, that a college or ſeminary in thoſe parts is very much wanted; and therefore the providing ſuch a ſeminary, is earneſtly propoſed and recommended to all thoſe, who have it in their power, to contribute to ſo good a work. By this, two ends would be obtained.

Firſt, the youth of our *Engliſh* plantations might be themſelves fitted for the miniſtry; and men of merit would be then glad to fill the churches of their native country, which are now a drain for the very dregs and refuſe of ours.

At preſent, there are, I am told, many churches vacant in our plantations, and many very ill ſupplied; nor can all the vigilance and wiſdom of that great prelate, whoſe peculiar care it is, prevent this, ſo long as the aforeſaid churches are ſupplied from *England.*

And ſupplied they muſt be, with ſuch as can be picked up in *England* or *Ireland*, until a nurſery of learning for the education of the natives is founded. This indeed might provide a conſtant ſucceſſion of learned and exemplary

exemplary paſtors; and what effect this muſt be ſuppoſed to have on their flocks, I need not ſay.

Secondly, the children of ſavage *Americans*, brought up in ſuch a ſeminary, and well inſtructed in religion and learning, might make the ableſt and propereſt miſſionaries for ſpreading the goſpel among their countrymen; who would be leſs apt to ſuſpect, and readier to embrace a doctrine recommended by neighbours or relations, men of their own blood and language, than if it were propoſed by foreigners, who would not improbably be thought to have deſigns on the liberty or property of their converts.

The young *Americans* neceſſary for this purpoſe, may, in the beginning be procured, either by peaceable methods from thoſe ſavage nations, which border on our colonies, and are in friendſhip with us, or by taking captive the children of our enemies.

It is propoſed to admit into the aforeſaid college only ſuch ſavages as are under ten years of age, before evil habits have taken a deep root; and yet not ſo early as to prevent retaining their mother tongue, which ſhould be preſerved by intercourſe among themſelves.

It is further propoſed, to ground theſe young *Americans* thoroughly in religion and morality, and to give them a good tincture of other learning; particularly of eloquence, hiſtory, and practical mathematicks; to which it may not be improper to add ſome ſkill in phyſic.

If there were a yearly ſupply of ten or a dozen ſuch miſſionaries ſent abroad into their reſpective countries, after they had received the degree of maſter of arts in the aforeſaid college, and holy orders in *England*, (till ſuch time as epiſcopacy be eſtabliſhed in thoſe parts) it is hardly to

be

be doubted, but, in a little time, the world would ſee good and great effects thereof.

For, to any conſidering man, the employing *American* miſſionaries for the converſion of *America*, will, of all others, appear the moſt likely method to ſucceed; eſpecially if care be taken, that, during the whole courſe of their education, an eye ſhould be had to their miſſion; that they ſhould be taught betimes to conſider themſelves as trained up in that ſole view, without any other proſpect of proviſion, or employment; that a zeal for religion, and love of their country, ſhould be early and conſtantly inſtilled into their minds, by repeated lectures and admonitions; that they ſhould not only be incited by the common topics of religion and nature, but farther animated and inflamed by the great examples in paſt ages, of public ſpirit and virtue, to reſcue their countrymen from their ſavage manners, to a life of civility and religion.

If his majeſty would graciouſly pleaſe to grant a charter for a college to be erected in a proper place for theſe uſes, it is to be hoped a fund may be ſoon raiſed, by the contribution of well-diſpoſed perſons, ſufficient for building and endowing the ſame. For as the neceſſary expence would be ſmall, ſo there are men of religion and humanity in *England*, who would be pleaſed to ſee any deſign ſet forward for the glory of God and the good of mankind.

A ſmall expence would ſuffice to ſubſiſt and educate the *American* miſſionaries in a plain ſimple manner, ſuch as might make it eaſy for them to return to the coarſe and poor methods of life in uſe among their countrymen; and nothing can contribute more to leſſen this expence, than a judicious choice of the ſituation, where the ſeminary is to ſtand.

Many things ought to be conſidered in the choice of a ſituation. It ſhould be in a good air; in a place where proviſions are cheap and plenty; where an intercourſe might eaſily be kept up with all parts of *America* and the iſlands; in a place of ſecurity, not expoſed to the inſults of pirates, ſavages, or other enemies; where there is no great trade, which might tempt the readers or fellows of the college to become merchants, to the neglect of their proper buſineſs; where there are neither riches nor luxury to divert, or leſſen their application, or to make them uneaſy and diſſatisfied with a homely frugal ſubſiſtence; laſtly, where the inhabitants, if ſuch a place may be found, are noted for innocence and ſimplicity of manners. I need not ſay of how great importance this point would be toward forming the morals of young ſtudents, and what mighty influence it muſt have on the miſſion.

It is evident the college long ſince projected in *Barbadoes* would be defective in many of theſe particulars; for though it may have its uſe among the inhabitants, yet a place of ſo high trade, ſo much wealth and luxury, and ſuch diſſolute morals, (not to mention the great price and ſcarcity of proviſions;) muſt at firſt ſight ſeem a very improper ſituation for a general ſeminary intended for the forming miſſionaries, and educating youth in religion and ſobriety of manners. The ſame objections lie againſt the neighbouring iſlands.

And if we conſider the accounts given of their avarice and licentiouſneſs, their coldneſs in the practice of religion, and their averſion from propagating it, (which appears in the withholding their ſlaves from baptiſm) it is to be feared, that the inhabitants in the populous parts of our plantations on the continent are not much fitter, than thoſe in the iſlands abovementioned, to influence or aſſiſt ſuch a deſign. And as to the more remote and leſs frequented parts, the difficulty of being ſupplied with neceſſaries, the danger of being expoſed to the inroads of ſavages, and

above

above all, the want of intercourſe with other places, render them improper ſituations for a ſeminary of religion and learning.

It will not be amiſs to inſert here an obſervation I remember to have ſeen in an abſtract of the proceedings, *&c.* annexed to the dean of *Canterbury*'s ſermon, before the ſociety for the propagation of the goſpel in foreign parts; that the ſavage *Indians*, who live on the continent, will not ſuffer their children to learn *Engliſh* or *Dutch*, leſt they ſhould be debauched by converſing with their *European* neighbours; which is a melancholy but ſtrong confirmation of the truth of what hath been now advanced.

A general intercourſe and correſpondence with all the *Engliſh* colonies, both on the iſlands and the continent, and with other parts of *America*, hath been before laid down, as a neceſſary circumſtance, the reaſon whereof is very evident. But this circumſtance is hardly to be found. For on the continent, where there are neither inns, nor carriages, nor bridges over the rivers, there is no travelling by land between diſtant places. And the *Engliſh* ſettlements are reputed to extend along the ſea-coaſt for the ſpace of fifteen hundred miles. It is therefore plain, there can be no convenient communication between them, otherwiſe than by ſea; no advantage therefore, in this point, can be gained by ſettling on the continent.

There is another conſideration which equally regards the continent and iſlands, that the general courſe of trade and correſpondence lies from all thoſe colonies to *Great-Britain* alone: whereas, for our preſent purpoſe, it would be neceſſary to pitch upon a place, if ſuch could be found, which maintains a conſtant intercourſe with all the other colonies, and whoſe commerce lies chiefly or altogether (not in *Europe*, but) in *America*.

There is but one ſpot that I can find, to which this circumſtance agrees; and that is the iſles of *Bermuda*, otherwiſe called the *Summer Iſlands*. Theſe having no rich commodity or manufacture, ſuch as ſugar, tobacco, or the like, wherewithal to trade to *England*, are obliged to become carriers for *America*, as the *Dutch* are for *Europe*. The *Bermudans* are excellent ſhipwrights and ſailors, and have a great number of very good ſloops, which are always paſſing and repaſſing from all parts of *America*. They drive a conſtant trade to the iſlands of *Jamaica*, *Barbadoes*, *Antego*, *&c.* with butter, onions, cabbages, and other roots and vegetables, which they have in great plenty and perfection. They have alſo ſome ſmall manufactures of joiner's work and matting, which they export to the plantations on the continent. Hence *Bermudan* ſloops are oftener ſeen in the ports of *America*, than any other. And indeed, by the beſt information I could get, it appears they are the only people of all the *Britiſh* plantations, who hold a general correſpondence with the reſt.

And, as the commerce of *Bermuda* renders it a very fit place, wherein to erect a ſeminary, ſo likewiſe doth its ſituation, it being placed between our plantations on the continent, and thoſe in the iſles, ſo as equally to reſpect both. To which may be added, that it lies in the way of veſſels paſſing from *America* to *Great-Britain*; all which makes it plain, that the youth, to be educated in a ſeminary placed in the *Summer Iſlands*, would have frequent opportunities of going thither and correſponding with their friends. It muſt indeed be owned, that ſome will be obliged to go a long way to any one place, which we ſuppoſe reſorted to, from all parts of our plantations; but if we were to look out a ſpot the neareſt approaching to an equal diſtance from all the reſt, I believe it would be found to be *Bermuda*. It remains, that we ſee whether it enjoys the other qualities or conditions laid down as well as this.

The

The *Summer Iſlands* are ſituated near the latitude of thirty three degrees; no part of the world enjoys a purer air, or a more temperate climate, the great ocean which environs them, at once moderating the heat of the ſouth winds, and the ſeverity of the north-weſt. Such a latitude on the continent might be thought too hot; but the air in *Bermuda* is perpetually fanned and kept cool by ſea-breezes, which render the weather the moſt healthy and delightful that could be wiſhed, being, (as is affirmed by perſons who have long lived there) of one equal tenor almoſt throughout the whole year, like the latter end of a fine *May*; inſomuch that it is reſorted to as the *Montpelier* of *America*.

Nor are theſe iſles (if we may believe the accounts given of them) leſs remarkable for plenty than for health; there being, beſides beef, mutton and fowl, great abundance of fruits, and garden-ſtuff of all kinds in perfection: to this, if we add the great plenty and variety of fiſh, which is every day taken on their coaſts, it would ſeem, that a ſeminary could no where be ſupplied with better proviſions, or cheaper than here.

About forty years ago, upon cutting down many tall cedars, that ſheltered their orange-trees from the north-weſt wind, (which ſometimes blows even there, ſo as to affect that delicate plant) great part of their orange plantations ſuffered; but other cedars are ſince grown up, and no doubt, a little induſtry would again produce as great plenty of oranges, as ever was there heretofore. I mention this, becauſe ſome have inferred from the preſent ſcarcity of that fruit, for which *Bermuda* was once ſo famous, that there hath been a change in the ſoil and climate for the worſe. But this, as hath been obſerved, proceeded from another cauſe, which is now in great meaſure taken away.

Bermuda is a cluſter of ſmall iſlands, which lie in a very narrow compaſs, containing, in all, not quite twenty thouſand acres. This group of

iſles

iſles is (to uſe Mr. *Waller*'s expreſſion) walled round with rocks, which render them inacceſſible to pirates or enemies; there being but two narrow entrances, both well guarded by forts. It would therefore be impoſſible to find any where, a more ſecure retreat for ſtudents.

The trade of *Bermuda* conſiſts only in garden-ſtuff, and ſome poor manufactures, principally of cedar and the palmetto-leaf. *Bermuda* hats are worn by our ladies: they are made of a ſort of mat, or (as they call it) platting made of the palmetto-leaf, which is the only commodity that I can find exported from *Bermuda* to *Great-Britain*; and as there is no proſpect of making a fortune by this ſmall trade, ſo it cannot be ſuppoſed to tempt the fellows of the college to engage in it, to the neglect of their peculiar buſineſs, which might poſſibly be the caſe elſewhere.

Such as their trade is, ſuch is their wealth; the inhabitants being much poorer than the other colonies, who do not fail to deſpiſe them upon that account. But if they have leſs wealth, they have withal leſs vice and expenſive folly than their neighbours. They are repreſented as a contented, plain, innocent ſort of people, free from avarice and luxury, as well as the other corruptions that attend thoſe vices.

I am alſo informed, that they are more conſtant attendants on divine ſervice, more kind and reſpectful to their paſtor (when they have one) and ſhew much more humanity to their ſlaves, and charity to one another, than is obſerved among the *Engliſh* in the other plantations: one reaſon of this may be, that condemned criminals, being employed in the manufactures of ſugar and tobacco, were never tranſported thither. But, whatever be the cauſe, the facts are atteſted by a clergyman of good credit, who lived long among them.

Among

Among a people of this character, and in a ſituation thus circumſtantiated, it would ſeem that a ſeminary of religion and learning might very fitly be placed. The correſpondence with other parts of *America*, the goodneſs of the air, the plenty and ſecurity of the place, the frugality and innocence of the inhabitants, all conſpiring to favour ſuch a deſign. Thus much at leaſt is evident, that young ſtudents would be there leſs liable to be corrupted in their morals; and the governing part would be eaſier, and better contented with a ſmall ſtipend, and a retired academical life, in a corner from whence avarice and luxury are excluded, than they can be ſuppoſed to be in the midſt of a full trade and great riches, attended with all that high living and parade which our planters affect, and which, as well as all faſhionable vices, ſhould be far removed from the eyes of the young *American* miſſionaries, who are to lead a life of poverty and ſelf-denial among their countrymen.

After all, it muſt be acknowledged, that though every thing elſe ſhould concur with our wiſhes, yet if a ſet of good governors and teachers be wanting, who are acquainted with the methods of education, and have the zeal and ability requiſite for carrying on a deſign of this nature, it would certainly come to nothing.

An inſtitution of this kind ſhould be ſet on foot by men of prudence, ſpirit and zeal, as well as competent learning, who ſhould be led to it by other motives than the neceſſity of picking up a maintenance. For upon this view, what man of merit can be ſuppoſed to quit his native country, and take up with a poor college-ſubſiſtence in another part of the world, where there are ſo many conſiderable pariſhes actually void, and ſo many others ill ſupplied for want of fitting incumbents? Is it likely, that fellowſhips of fifty or ſixty pounds a year ſhould tempt abler or worthier men, than benefices of many times their value?

And

And except able and worthy men do firſt engage in this affair, with a reſolution to exert themſelves in forming the manners of the youth, and giving them a proper education, it is evident the miſſion and the college will be but in a very bad way. This inconvenience ſeems the moſt difficult to provide againſt, and, if not provided againſt, it will be the moſt likely to obſtruct any deſign of this nature. So true it is, that where ignorance or ill manners once take place in a ſeminary, they are ſure to be handed down in a ſucceſſion of illiterate or worthleſs men.

But this apprehenſion, which ſeems ſo well grounded, that a college in any part of *America* would either lie unprovided, or be worſe provided than their churches are, hath no place in *Bermuda*; there being at this time ſeveral gentlemen, in all reſpects very well qualified, and in poſſeſſion of good preferments, and fair proſpects at home, who having ſeriouſly conſidered the great benefit that may ariſe to the church and to mankind from ſuch an undertaking, are ready to engage in it, and to dedicate the remainder of their lives to the inſtructing the youth of *America*, and proſecuting their own ſtudies upon a very moderate ſubſiſtence in a retirement, ſo ſweet and ſo ſecure, and every way ſo well fitted for a place of education and ſtudy, as *Bermuda*.

Thus much the writer hereof thought himſelf obliged to ſay of his aſſociates: for himſelf, he can only ſay, that as he values no preferment upon earth, ſo much as that of being employed in the execution of this deſign; ſo he hopes to make up for other defects, by the ſincerity of his endeavours.

In *Europe*, the proteſtant religion hath of late years conſiderably loſt ground, and *America* ſeems the likelieſt place, wherein to make up for what hath been loſt in *Europe*, provided the proper methods are taken: otherwiſe the *Spaniſh* miſſionaries in the ſouth, and the *French* in the north,

north, are making ſuch a progreſs, as may one day ſpread the religion of *Rome*, and with it the uſual hatred to proteſtants, throughout all the ſavage nations in *America*; which would probably end in the utter extirpation of our colonies, on the ſafety whereof depends ſo much of the nation's wealth, and ſo conſiderable a branch of his majeſty's revenue.

But if this ſcheme were purſued, it would in all probability have much greater influence on the *Americans*, than the utmoſt endeavours of popiſh emiſſaries can poſſibly have; who from the difference of country, language and intereſt, muſt lie under far greater difficulties and diſcouragements than thoſe, whom we ſuppoſe yearly ſent out from *Bermuda* to preach among their countrymen.

It cannot indeed be denied, that the great number of poor regulars, inured to hard living, and brought up in an implicit obedience to their ſuperiors, hath hitherto given the church of *Rome*, in regard to her miſſions, great advantage over the reformed churches. But from what hath been ſaid, it is, I think, evident, that this advantage may be over-balanced by our employing *American* miſſionaries.

Nor is the honour of the crown, nation, and church of *England* unconcerned in this ſcheme; which, it is to be hoped, will remove the reproach, we have ſo long lain under, that we fall as far ſhort of our neighbours of the *Romiſh* communion in zeal for propagating religion, as we ſurpaſs them in the ſoundneſs and purity of it. And at the ſame time, that the doing what may be ſo eaſily done, takes away our reproach; it will caſt no ſmall luſtre on his majeſty's reign, and derive a bleſſing from heaven on his adminiſtration, and thoſe who live under the influence thereof.

Men of narrow minds have a peculiar talent at objection, being never at a loſs for ſomething to ſay againſt whatſoever is not of their own

propoſing. And perhaps, it will be ſaid in oppoſition to this propoſal, that if we thought ourſelves capable of gaining converts to the church, we ought to begin with infidels, papiſts, and diſſenters of all denominations at home, and to make proſelytes of theſe before we think of foreigners; and that therefore our ſcheme is againſt duty. And further, that conſidering the great oppoſition, which is found on the part of thoſe who differ from us at home, no ſucceſs can be expected among ſavages abroad, and that therefore it is againſt reaſon and experience.

In anſwer to this I ſay, that religion like light is imparted without being diminiſhed. That whatever is done abroad, can be no hindrance or lett to the converſion of infidels or others at home. That thoſe who engage in this affair, imagine they will not be miſſed, where there is no want of ſchools or clergy; but that they may be of ſingular ſervice in countries but thinly ſupplied with either, or altogether deprived of both: that our colonies being of the ſame blood, language and religion, with ourſelves, are in effect our countrymen. But that chriſtian charity, not being limited by thoſe regards, doth extend to all mankind. And this may ſerve for an anſwer to the firſt point, that our deſign is againſt duty.

To the ſecond point I anſwer; that ignorance is not ſo incurable as error; that you muſt pull down as well as build, eraſe as well as imprint, in order to make proſelytes at home: whereas, the ſavage *Americans*, if they are in a ſtate purely natural, and unimproved by education, they are alſo unincumbered with all that rubbiſh of ſuperſtition and prejudice, which is the effect of a wrong one. As they are leſs inſtructed, they are withal leſs conceited and more teachable. And not being violently attached to any falſe ſyſtem of their own, are ſo much the fitter to receive that which is true. Hence it is evident, that ſucceſs abroad ought not to be meaſured by that which we obſerve at home, and that the inference,

which

which was made from the difficulty of the one to the impoſſibility of the other, is altogether groundleſs.

It hath more the appearance of reaſon to object (what will poſſibly be objected by ſome) that this ſcheme hath been already tried to no purpoſe, ſeveral *Indians* having returned to their ſavage manners after they had been taught to write and read, and inſtructed in the chriſtian religion; a clear proof that their natural ſtupidity is not to be overcome by education.

In anſwer to this, I ſay, that the ſcheme now propoſed hath never been tried, foraſmuch as a thorough education in religion and morality, in divine and human learning, doth not appear to have been ever given to any ſavage *American:* that much is to be hoped from a man ripe in years, and well grounded in religion and uſeful knowledge, while little or nothing can be expected from a youth but ſlightly inſtructed in the elements of either: that from the miſcarriage or groſs ſtupidity of ſome, a general incapacity of all *Americans* cannot be fairly inferred: that they ſhew as much natural ſenſe as other uncultivated nations: that the empires of *Mexico* and *Peru* were evident proofs of their capacity, in which there appeared a reach of politics, and a degree of art and politeneſs, which no *European* people were ever known to have arrived at without the uſe of letters or of iron, and which ſome perhaps have fallen ſhort of with both thoſe advantages.

To what hath been ſaid, it may not be improper to add, that young *Americans*, educated in an iſland at ſome diſtance from their own country, will more eaſily be kept under diſcipline till they have attained a complete education, than on the continent; where they might find opportunities of running away to their countrymen, and returning to their

brutal cuſtoms, before they were thoroughly imbued with good principles and habits.

It muſt nevertheleſs be acknowledged a difficult attempt, to plant religion among the *Americans*, ſo long as they continue their wild and roving life. He who is obliged to hunt for his daily food, will have little curioſity or leiſure to receive inſtruction. It would ſeem therefore the right way, to introduce religion and civil life at the ſame time into that part of the world: either attempt will aſſiſt and promote the other. Thoſe therefore of the young ſavages, who upon trial are found leſs likely to improve by academical ſtudies, may be taught agriculture, or the moſt neceſſary trades. And when huſbandmen, weavers, carpenters, and the like, have planted thoſe uſeful arts among their ſavage countrymen, and taught them to live in ſettled habitations, to canton out their land and till it, to provide vegetable food of all kinds, to preſerve flocks and herds of cattle, to make convenient houſes, and to clothe themſelves decently: this will aſſiſt the ſpreading the goſpel among them; this will diſpoſe them to ſocial virtues, and enable them to ſee and to feel the advantages of a religious and civil education.

And that this view of propagating the goſpel and civil life among the ſavage nations of *America*, was a principal motive which induced the crown to ſend the firſt *Engliſh* colonies thither, doth appear from the charter granted by king *James* I. to the adventurers in *Virginia*. *See* Purchas's *Pilgrims*, vol. 4. b. I. c. 9. And it is now but juſt (what might then ſeem charitable) that theſe poor creatures ſhould receive ſome advantage with reſpect to their ſpiritual intereſts, from thoſe who have ſo much improved their temporal, by ſettling among them.

It is moſt true, notwithſtanding our preſent corruptions, that there are to be found in no country under the ſun men of better inclinations,

or

or greater abilities for doing good, than in *England.* But it is as true, that ſucceſs, in many caſes, depends not upon zeal, induſtry, wealth, learning, or the like faculties, ſo much as on the method, wherein theſe are applied. We often ſee a ſmall proportion of labour and expence in one way, bring that about, which in others, a much greater ſhare of both could never effect. It hath been my endeavour to diſcover this way or method in the preſent caſe. What hath been done, I ſubmit to the judgment of all good and reaſonable men; who, I am perſuaded, will never reject or diſcourage a propoſal of this nature, on the ſcore of ſlight objections, ſurmiſes, or difficulties, and thereby render themſelves chargeable with the having prevented thoſe good effects, which might otherwiſe have been produced by it.

For it is, after all, poſſible, that unforeſeen difficulties may ariſe in the proſecution of this deſign, many things may retard, and many things may threaten to obſtruct it; but there is hardly any enterprize or ſcheme whatſoever, for the public good, in which difficulties are not often ſhewing themſelves, and as often overcome by the bleſſing of God, upon the prudence and reſolution of the undertakers; though, for ought that appears, the preſent ſcheme is as likely to ſucceed, and attended with as few difficulties, as any of this kind can poſſibly be.

For to any man, who conſiders the divine power of religion, the innate force of reaſon and virtue, and the mighty effects often wrought by the conſtant regular operation even of a weak and ſmall cauſe; it will ſeem natural and reaſonable to ſuppoſe, that rivulets perpetually iſſuing forth from a fountain, or reſervoir, of learning and religion, and ſtreaming through all parts of *America*, muſt in due time have a great effect, in purging away the ill manners and irreligion of our colonies, as well as the blindneſs and barbarity of the nations round them: eſpecially, if the reſervoir be in a clean and private place, where its waters, out of the way

way of any thing that may corrupt them, remain clear and pure; otherwiſe they are more likely to pollute than purify the places through which they flow.

The greatneſs of a beneſaction is rather in proportion to the number and want of the receivers, than to the liberality of the giver. A wiſe and good man would therefore be frugal in the management of his charity; that is, contrive it ſo as that it might extend to the greateſt wants of the greateſt number of his fellow-creatures. Now the greateſt wants are ſpiritual wants, and by all accounts theſe are no where greater than in our weſtern plantations, in many parts whereof divine ſervice is never performed for want of clergymen; in others, after ſuch a manner and by ſuch hands, as ſcandalize even the worſt of their own pariſhioners; where many *Engliſh*, inſtead of gaining converts, are themſelves degenerated into heathens, being members of no church, without morals, without faith, without baptiſm. There can be therefore, in no part of the chriſtian world, a greater want of ſpiritual things than in our plantations.

And, on the other hand, no part of the gentile world are ſo inhuman and barbarous as the ſavage *Americans*, whoſe chief employment and delight conſiſting in cruelty and revenge, their lives muſt of all others, be moſt oppoſite, as well to the light of nature, as to the ſpirit of the goſpel. Now to reclaim theſe poor wretches, to prevent the many torments and cruel deaths which they daily inflict on each other, to contribute in any ſort to put a ſtop to the numberleſs horrid crimes which they commit without remorſe, and inſtead thereof to introduce the practice of virtue and piety, muſt ſurely be a work in the higheſt degree becoming every ſincere and charitable chriſtian.

Thoſe, who wiſh well to religion and mankind, will need no other motive to forward an undertaking calculated for the ſervice of both: I ſhall, nevertheleſs,

nevertheleſs, beg leave to obſerve, that whoever would be glad to cover a multitude of ſins by an extenſive and well judged charity, or whoever, from an excellent and godlike temper of mind, ſeeks opportunities of doing good in his generation, will be pleaſed to meet with a ſcheme that ſo peculiarly puts it in his power, with ſmall trouble or expence, to procure a great and laſting benefit to the world.

Ten pounds a year, would (if I miſtake not) be ſufficient to defray the expence of a young *American* in the college of *Bermuda*, as to diet, lodging, clothes, books and education: and if ſo, the intereſt of two hundred pounds may be a perpetual fund for maintaining one miſſionary at the college for ever; and in this ſucceſſion many, it is to be hoped, may become powerful inſtruments for converting to chriſtianity and civil life whole nations, who now ſit in darkneſs and the ſhadow of death, and whoſe cruel brutal manners are a diſgrace to human nature.

A benefaction of this kind ſeems to enlarge the very being of a man, extending it to diſtant places and to future times; inaſmuch as unſeen countries and after ages may feel the effects of his bounty, while he himſelf reaps the reward in the bleſſed ſociety of all thoſe, who, *having turned many to righteouſneſs, ſhine as the ſtars for ever and ever.*

VERSES,

ON THE

Proſpect of planting ARTS and LEARNING

IN

AMERICA.

VERSES, &c.

THE Muſe, diſguſted at an age and clime,
Barren of every glorious theme,
In diſtant lands now waits a better time,
Producing ſubjects worthy fame:

In happy climes, where from the genial ſun
And virgin earth ſuch ſcenes enſue,
The force of art by nature ſeems outdone,
And fancied beauties by the true:

In happy climes the ſeat of innocence,
Where nature guides and virtue rules,
Where men ſhall not impoſe for truth and ſenſe,
The pedantry of courts and ſchools:

There ſhall be ſung another golden age,
The riſe of empire and of arts,
The good and great inſpiring epic rage,
The wiſeſt heads and nobleſt hearts.

Not ſuch as *Europe* breeds in her decay;
  Such as ſhe bred when freſh and young,
When heavenly flame did animate her clay,
  By future poets ſhall be ſung.

Weſtward the courſe of empire takes its way;
  The four firſt acts already paſt,
A fifth ſhall cloſe the drama with the day;
  Time's nobleſt offspring is the laſt.

A

SERMON

Preached before the

INCORPORATED SOCIETY,

FOR THE

Propagation of the GOSPEL in Foreign Parts,

AT THEIR

Anniverſary Meeting in the Pariſh-Church of St. MARY-LE-BOW,

On Friday, February 18, 1731.

A

SERMON, &c.

JOHN xvii. v. 3.

This is life eternal, that they may know thee the only true God, and Jeſus Chriſt whom thou haſt ſent.

THAT human kind were not deſigned merely to ſojourn a few days upon this earth: that a being of ſuch excellence as the ſoul of man, ſo capable of a nobler life, and having ſuch a high ſenſe of things moral and intellectual, was not created in the ſole view of being impriſoned in an earthly tabernacle, and partaking a few pains and pleaſures which chequer this mortal life, without aſpiring to any thing either above or beyond it, is a fundamental doctrine as well of natural religion as of the chriſtian. It comes at once recommended by the authority of philoſophers and evangeliſts. And that there actually is in the mind of man a ſtrong inſtinct and deſire, an appetite and tendency towards another and a better ſtate, incomparably ſuperior to the preſent, both in point of happineſs and duration, is no more than every one's experience and inward feeling may inform him. The ſatiety and diſreliſh attending ſenſual enjoyments, the reliſh for things of a more pure and ſpiritual kind, the reſtleſs motion of the mind, from one terrene object or purſuit to another, and often a flight or endeavour above them all towards ſomething unknown, and perfective of its nature, are ſo many ſigns and tokens

kens of this better ſtate, which in the ſtyle of the goſpel is termed life] eternal.

And as this is the greateſt good that can befal us, the very end of our being, and that alone which can crown and ſatisfy our wiſhes, and without which we ſhall be ever reſtleſs and uneaſy; ſo every man, who knows and acts up to his true intereſt, muſt make it his principal care and ſtudy to obtain it: and in order to this, he muſt endeavour to live ſuitably to his calling, and of conſequence endeavour to make others obtain it too. For how can a chriſtian ſhew himſelf worthy of his calling, otherwiſe than by performing the duties of it? And what chriſtian duty is more eſſentially ſo, than that of charity? And what object can be found upon earth more deſerving our charity, than the ſouls of men? Or, how is it poſſible for the moſt beneficent ſpirit to do them better ſervice, than by promoting their beſt and moſt laſting intereſt, that is, by putting them in the way that leads to eternal life.

What this eternal life was, or how to come at it, were points unknown to the heathen world. It muſt be owned, the wiſe men of old, who followed the light of nature, ſaw even by that light, that the ſoul of man was debaſed, and borne downwards, contrary to its natural bent, by carnal and terrene objects; and that, on the other hand, it was exalted, purged, and in ſome ſort aſſimulated to the Deity, by the contemplation of truth and practice of virtue. Thus much in general they ſaw or ſurmiſed. But then about the way and means to know the one, or perform the other, they were much at a loſs. They were not agreed concerning the true end of mankind; which, as they ſaw, was miſtaken in the vulgar purſuits of men; ſo they found it much more eaſy to confute the errors of others, than to aſcertain the truth themſelves. Hence ſo many diviſions and diſputes about a point which it moſt imported them to

to know, inſomuch as it was to give the bias to human life, and govern the whole tenor of their actions and conduct.

But when life and immortality were brought to light by the goſpel, there could remain no diſpute about the chief end and felicity of man, no more than there could about the means of obtaining it, after the expreſs declaration of our bleſſed Lord in the words of my text; *this is life eternal, that they may know thee, the only true God, and Jeſus Chriſt whom thou haſt ſent.* For the right underſtanding of which words we muſt obſerve, that by the knowledge of God, is not meant a barren ſpeculation, either of philoſophers or ſcholaſtic divines, nor any notional tenets fitted to produce diſputes and diſſentions among men; but, on the contrary, an holy practical knowledge, which is the ſource, the root, or principle of peace and union, of faith, hope, charity, and univerſal obedience. A man may frame the moſt accurate notions, and in one ſenſe attain the exacteſt knowledge of God and Chriſt that human faculties can reach, and yet, notwithſtanding all this, be far from knowing them in that ſaving ſenſe. For St. *John* tells us, that * *whoſoever ſinneth, hath not ſeen Chriſt, nor known him.* And again, † *he that loveth not, knoweth not God.* To know God as we ought, we muſt love him; and love him ſo as withal to love our brethren, his creatures and his children. I ſay, that knowledge of God and Chriſt, which is life eternal, implies univerſal charity, with all the duties ingrafted thereon, or enſuing from thence, that is to ſay, the love of God and man. And our Lord expreſly ſaith, ‡ *he that hath my commandments, and keepeth them, he it is that loveth me.* From all which it is evident, that this ſaving knowledge of God is inſeparable from the knowledge and practice of his will; the explicit declaration whereof, and of the means to perform it, are contained in the goſpel, that divine inſtrument of grace and mercy to the ſons of men. The metaphyſical

* 1 John iii. 6. † 1 John iv. 8. ‡ John xiv. 21.

knowledge of God, conſidered in his abſolute nature or eſſence, is one thing, and to know him as he ſtands related to us as Creator, Redeemer, and Sanctifier, is another. The former kind of knowledge (whatever it amounts to) hath been, and may be, in Gentiles as well as Chriſtians, but not the latter, which is life eternal.

From what has been ſaid, it is a plain conſequence, that whoever is a ſincere chriſtian, cannot be indifferent about bringing over other men to the knowledge of God and Chriſt; but that every one of us, who hath any claim to that title, is indiſpenſably obliged in duty to God, and in charity to his neighbour, to deſire and promote, ſo far as there is opportunity, the converſion of heathens and infidels, that ſo they may become partakers of life and immortality. For, *this is life eternal, to know thee the only true God, and Jeſus Chriſt whom thou haſt ſent.*

In my preſent diſcourſe upon which words; I ſhall,

Firſt, conſider in general, the obligation that chriſtians lie under, of bringing other men to the knowledge of the only true God, and of Jeſus Chriſt. And,

Secondly, I ſhall conſider it in reference to this laudable ſociety, inſtituted for the propagation of the goſpel. And under each head; I propoſe to obviate ſuch difficulties as may ſeem to retard, and intermix ſuch remarks as ſhall appear proper to forward ſo good a work.

Now although it be very evident, that we can really have neither a juſt zeal for the glory of God, nor a beneficent love of man, without wiſhing and endeavouring, as occaſion ſerves, to ſpread the glad tidings of ſalvation, and bring thoſe who are benighted in the ſhadow of death, to life eternal, by the knowledge of the only true God, and of Jeſus Chriſt whom

whom he hath ſent. Yet this duty, plain and undoubted as it ſeems, happens to be too often overlooked, even by thoſe whoſe attention to other points would make one think their neglect of this, not an effect of lukewarm indifference, ſo much as of certain miſtaken notions and ſuppoſitions. Two principal conſiderations occur, which, in this particular, ſeem to have ſlackened the induſtry of ſome, otherwiſe zealous and ſerious chriſtians.

One I apprehend to be this, that it is ſurmiſed, the chriſtian religion is in a declining ſtate, which by many ſymptoms ſeems likely to end either in popery, or a general infidelity. And that of courſe a prudent perſon has nothing to do, but to make ſure of his own ſalvation, and to acquieſce in the general tendency of things, without being at any fruitleſs pains to oppoſe what cannot be prevented, to ſteer againſt the ſtream, or reſiſt a torrent, which as it flows, gathers ſtrength and rapidity, and in the end, will be ſure to overflow, and carry all before it. When a man of a deſponding and foreboding ſpirit hath been led, by his obſervation of the ways of the world, and the prevailing humour of our times, to think after this manner; he will be inclined to ſtrengthen this his preconceived opinion, as is uſual in other the like caſes, by miſapplication of holy ſcripture: for inſtance, by thoſe words of our bleſſed Saviour, * *when the Son of man cometh, ſhall he find faith on the earth?* which have been applied to this very purpoſe, as importing that before the final judgment, chriſtian faith ſhould be extinguiſhed upon earth; although theſe words do, from the context, ſeem plainly to refer to the deſtruction of *Jeruſalem*, and the obſtinate blindneſs of the *Jews*, who even then when they felt the hand of God, ſhould not acknowledge it, or believe the *Roman* army to be the inſtrument of divine vengeance, in the day of their viſitation, by him whom they had injuriouſly treated, rejected, and put to death.

* Luke xviii. 8.

But, granting the former ſenſe might be ſupported by no abſurd hypotheſis, or no improbable gueſs; yet ſhall the endeavours of chriſtian men for propagating the goſpel of Chriſt be foreſtalled by any ſuppoſitions or conjectures whatſoever? Admitting, I ſay, thoſe words regard the future advent of Jeſus Chriſt, yet can any one tell how near or how far off that advent may be? Are not the times and ſeaſons foreknown only to God? And ſhall we neglect a certain duty to day, upon an uncertain ſurmiſe of what is to come hereafter? This way of thinking might furniſh as ſtrong reaſons againſt preaching at home, as abroad, within, as without the pale of the church. It would be as ſpecious an argument againſt the one as the other, but in reality can conclude againſt neither. For, as we know not when that ſuppoſed time of general infidelity is to be, or whether it will be at all; ſo, if it were ever ſo ſure, and ever ſo near, it would nevertheleſs become us to take care, that it may not be an effect of our own particular indifference and neglect.

But if we take our notions, not from the uncertain interpretation of a particular text, but from the whole tenor of the divine oracles, from the expreſs promiſe and reiterated predictions of our bleſſed Lord and his apoſtles, we ſhall believe, that * *Jeſus Chriſt is highly exalted of God, to the end; that at his name every knee ſhall bow, and every tongue confeſs that he is the Lord, to the glory of God the Father.* That † *he muſt reign till he hath put all enemies under his feet.* That ‡ *he is with us alway, even unto the end of the world.* And that, the church of the living God, the pillar and ground of truth, is ſo far from being deſtroyed by human means, § *that the gates of hell* (all the infernal powers) *ſhall not prevail againſt it.* Let us therefore baniſh all ſuch conceits as may ſeem to juſtify our indolence, as may reaſon us out of all courage and vigour in the race that is ſet before us; let us not, I ſay, ſlacken our own hands, nor enfeeble our own knees,

* Phil. ii. 9, 10, 11. † 1 Cor. xv. 25. ‡ Mat. xxviii. 20. § Mat. xvi. 18.

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by preconceived fancies and ſuppoſitions, conſidering that as the ſucceſs of all enterpriſes in great meaſure depends on the ſpirit of the undertakers, ſo nothing is more apt to raiſe a ſpirit than hope; nor to depreſs it, than deſpondency. We ought therefore to ſhake off every vain fear in our ſpiritual warfare. The number, the preſumption, and the abilities of thoſe, who take counſel together againſt the Lord and againſt his anointed, ſhould not diſhearten, but rather excite and encourage us to ſtand in the gap.

Another conſideration, that may poſſibly withhold divers ſincere believers from contributing their endeavours for bringing men to the knowledge of God and Chriſt, and thereby to eternal life, is the want of miracles in the preſent age. Men naturally caſt about for reaſons to countenance the part they take. And as the gift of miracles was of mighty influence and help to thoſe, who were commiſſioned to ſpread abroad the light of the goſpel in its firſt promulgation, ſo no pretence offers itſelf more naturally to excuſe a man from executing any purpoſe, than the want of authority, which, in the opinion of men, cannot be without a juſt commiſſion, nor this unleſs diſtinguiſhed by thoſe proper means and powers that have been known to attend it. Now, with regard to this defect of miracles, I ſhall beg leave to make two obſervations.

Firſt, It is to be obſerved, that if we have not miracles, we have other advantages which make them leſs neceſſary now, than in the firſt ſpreading of the goſpel: whole nations have found the benefit of Chriſt's religion, it is protected by princes, eſtabliſhed and encouraged by laws, ſupported by learning and arts, recommended by the experience of many ages, as well as by the authority and example of the wiſeſt and moſt knowing men. Certainly, if the greateſt part of mankind are Gentiles or Mahometans, it cannot be denied that the moſt knowing, moſt learned, and moſt improved nations, profeſs chriſtianity; and that even the Mahometans,

hometans themſelves bear teſtimony to the divine miſſion of Jeſus Chriſt. Whereas therefore, in the beginning, a few illiterate wanderers, of the meaneſt of the people, had the prejudices, the learning, and the power of their own, as well as other nations, in one word, the whole world, to oppoſe and overcome: thoſe who at this day engage in the propagation of the goſpel, do it upon terms in many reſpects far more eaſy and advantageous. It is power againſt weakneſs, civility againſt barbariſm, knowledge againſt ignorance, ſome or other, if not all theſe advantages, in the preſent times, attending the progreſs of the chriſtian religion, in whatever part of the world men ſhall attempt to plant it.

In the ſecond place we may reflect, that if we have not the gift of miracles, this is a good reaſon why we ſhould exert more ſtrongly thoſe human means which God hath put in our power; and make our ordinary faculties, whether of the head, or the hand, or the tongue, our intereſt, our credit, or our fortune, ſubſervient to the great giver of them; and chearfully contribute our humble mite towards haſtening that time, wherein * *all nations whom thou haſt made, ſhall come and worſhip before thee, O Lord, and ſhall glorify thy name.* It is at leaſt a plain caſe, that the want of apoſtolical gifts ſhould not be pleaded as a bar to our doing that, which in no reſpect, either of difficulty or danger, equals, or approaches the apoſtolical office. What pretence can this ſupply for mens being quite unconcerned about the ſpreading of the goſpel, or the ſalvation of ſouls? for mens forgetting that they are chriſtians, and related to human kind? How can this juſtify their overlooking opportunities which lie in their way, their not contributing a ſmall part of their fortune towards forwarding a deſign, wherein they ſhare neither pains nor peril; the not beſtowing on it, even the cheap aſſiſtance of their ſpeech, attention, counſel, or countenance, as occaſion offers? How unlike is this worldly, ſelfiſh indifference, to that account which St. *Paul* gives of him-

* Pſalm lxxxvi. 9.

ſelf,

ſelf, that * *he ſought not his own profit, but the profit of many, that they may be ſaved.* And yet herein he expected the *Corinthians* (and the ſame reaſon will hold for us) ſhould be like him; for he ſubjoins *be ye followers of me as I alſo am of Chriſt.*

Having conſidered the duty in general, I come now to treat of it with reference to *America*, the peculiar province of this venerable ſociety; which I ſuppoſe well informed of the ſtate and progreſs of religion in that part of the world, by their correſpondencies with the clergy upon their miſſion. It may nevertheleſs be expected that one who had been engaged in a deſign upon this very view, who hath been upon the place, and reſided a conſiderable time in one of our colonies, ſhould have obſerved ſomewhat worth reporting. It is to be hoped, therefore, that one part of my audience will pardon, what the other may, perhaps, expect, while I detain them with the narrative of a few things I have obſerved, and ſuch reflections as thereupon ſuggeſted themſelves; ſome part of which may poſſibly be found to extend to other colonies.

Rhode-Iſland, with a portion of the adjacent continent, under the ſame government, is inhabited by an *Engliſh* colony, conſiſting chiefly of ſectaries of many different denominations, who ſeem to have worn off part of that prejudice, which they inherited from their anceſtors, againſt the national church of this land; though it muſt be acknowledged at the ſame time, that too many of them have worn off a ſerious ſenſe of all religion. Several indeed of the better ſort are accuſtomed to aſſemble themſelves regularly on the Lord's day for the performance of divine worſhip. But moſt of thoſe, who are diſperſed throughout this colony, ſeem to rival ſome well-bred people of other countries, in a thorough indifference for all that is ſacred, being equally careleſs of outward worſhip, and of inward principles, whether of faith or practice. Of the bulk of them

* 1 Cor. x. 33.

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it may certainly be ſaid, that they live without the ſacraments, not being ſo much as baptized: and as for their morals, I apprehend there is nothing to be found in them that ſhould tempt others to make an experiment of their principles, either in religion or government. But it muſt be owned, the general behaviour of the inhabitants in thoſe towns where churches and meetings have been long ſettled, and regularly attended, ſeems ſo much better, as ſufficiently to ſhew the difference, which a ſolemn regular worſhip of God makes between perſons of the ſame blood, temper, and natural faculties.

The native Indians, who are ſaid to have been formerly many thouſands, within the compaſs of this colony, do not at preſent amount to one thouſand, including every age and ſex. And theſe are either all ſervants or labourers for the *Engliſh*, who have contributed more to deſtroy their bodies by the uſe of ſtrong liquors, than by any means to improve their minds, or ſave their ſouls. This ſlow poiſon, jointly operating with the ſmall-pox, and their wars (but much more deſtructive than both) hath conſumed the *Indians*, not only in our colonies, but alſo far and wide upon our confines. And having made havock of them, is now doing the ſame thing by thoſe who taught them that odious vice.

The negroes in the government of *Rhode-Iſland* are about half as many more than the *Indians*; and both together ſcarce amount to a ſeventh part of the whole colony. The religion of theſe people, as is natural to ſuppoſe, takes after that of their maſters. Some few are baptized; ſeveral frequent the different aſſemblies: and far the greater part none at all. An ancient antipathy to the *Indians*, whom, it ſeems, our firſt planters (therein as in certain other particulars affecting to imitate Jews rather than chriſtians) imagine they had a right to treat on the foot of *Canaanites* or *Amalekites*, together with an irrational contempt of the Blacks, as creatures of another ſpecies, who had no right to be inſtructed or admitted

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to the ſacraments, have proved a main obſtacle to the converſion of theſe poor people.

To this may be added, an erroneous notion, that the being baptized, is inconſiſtent with a ſtate of ſlavery. To undeceive them in this particular, which had too much weight, it ſeemed a proper ſtep, if the opinion of his majeſty's attorney and ſolicitor-general could be procured. This opinion they charitably ſent over, ſigned with their own hands; which was accordingly printed in *Rhode-Iſland*, and diſperſed throughout the plantations. I heartily wiſh it may produce the intended effect. It muſt be owned, our reformed planters, with reſpect to the natives and the ſlaves, might learn from thoſe of the church of *Rome*, how it is their intereſt and duty to behave. Both *French* and *Spaniards* have intermarried with *Indians*, to the great ſtrength, ſecurity and increaſe of their colonies. They take care to inſtruct both them and their negroes, in the popiſh religion, to the reproach of thoſe who profeſs a better. They have alſo biſhops and ſeminaries for clergy; and it is not found that their colonies are worſe ſubjects, or depend leſs on their mother country, on that account.

It ſhould ſeem, that the likelieſt ſtep towards converting the heathen would be to begin with the *Engliſh* planters; whoſe influence will for ever be an obſtacle to propagating the goſpel, till they have a right ſenſe of it themſelves, which would ſhew them how much it is their duty to impart it to others. The miſſionaries employed by this venerable ſociety have done, and continue to do, good ſervice, in bringing thoſe planters to a ſerious ſenſe of religion, which, it is hoped, will in time extend to others. I ſpeak it knowingly, that the miniſters of the goſpel, in thoſe provinces which go by the name of *New-England*, ſent and ſupported at the expence of this ſociety, have, by their ſobriety of manners, diſcreet behaviour, and a competent degree of uſeful knowledge, ſhewn themſelves

worthy the choice of thoſe who ſent them; and particularly in living on a more friendly foot with their brethren of the ſeparation; who, on their part, were alſo very much come off from that narrowneſs of ſpirit, which formerly kept them at ſuch an unamicable diſtance from us. And as there is reaſon to apprehend, that part of *America* could not have been thus diſtinguiſhed, and provided with ſuch a number of proper perſons, if one half of them had not been ſupplied out of the diſſenting ſeminaries of the country, who, in proportion as they attain to more liberal improvements of learning, are obſerved to quit their prejudice towards an epiſcopal church; ſo I verily think it might increaſe the number of ſuch uſeful men, if proviſion were made to defray their charges in coming hither to receive holy orders; paſſing and repaſſing the ocean, and tarrying the neceſſary time in *London*, requiring an expence that many are not able to bear. It would alſo be an encouragement to the miſſionaries in general, and probably produce good effects, if the allowance of certain miſſionaries were augmented, in proportion to the ſervices they had done, and the time they had ſpent in their miſſion. Theſe hints I venture to ſuggeſt, as not unuſeful in an age, wherein all human encouragements are found more neceſſary, than at the firſt propagation of the goſpel. But they are, with all due deference and reſpect, ſubmitted to the judgment of this venerable audience.

After all, it is hardly to be expected, that ſo long as infidelity prevails at home, the chriſtian religion ſhould thrive and flouriſh in our colonies abroad. Mankind, it muſt be owned, left to themſelves, are ſo much bewildered and benighted, with reſpect to the origin of that evil which they feel, and from which they are at a loſs about the means of being freed; that the doctrines of the lapſed ſtate of man, his reconciliation by Chriſt, and regeneration by the Spirit, may reaſonably be hoped to find an eaſy admiſſion, as bringing with them light and comfort, into a mind not hardened by impenitency, nor fore-cloſed by pride, nor biaſed by prejudice.

prejudice. But, ſuch is the vanity of man, that no prejudice operates more powerfully than that in favour of faſhion; and no faſhions are ſo much followed by our colonies, as thoſe of the mother country, which they often adopt in their modes of living, to their great inconvenience, without allowing for the diſparity of circumſtance or climate. This ſame humour hath made infidelity (as I find it too credibly reported) ſpread in ſome of our wealthy plantations; uneducated men being more apt to tread in the ſteps of libertines and men of faſhion, than to model themſelves by the laws and inſtitutions of their mother country, or the lives and profeſſions of the virtuous and religious part of it.

But this is not all; while thoſe abroad are leſs diſpoſed to receive, ſome at home are, perhaps, leſs diſpoſed to propagate the goſpel, from the ſame cauſe. It is to be feared, I ſay, that the prevailing torrent of infidelity, which ſtaggers the faith of ſome, may cool the zeal and damp the ſpirit of others, who, judging from the event and ſucceſs of thoſe who impugn the church of Chriſt, may poſſibly entertain ſome ſcruple or ſurmiſe, whether it may not be, for the preſent at leaſt, abandoned by Providence, and that human care muſt ineffectually interpoſe, till it ſhall pleaſe God, *yet once more to ſhake not the earth only, but alſo the heavens.* This point hath been touched before, but deſerves farther conſideration: to the end, that the peculiar impiety of a profane age, may not be a bar to thoſe very endeavours, which itſelf renders more neceſſary, and calls for more loudly now than ever.

Whatever men may think, the arm of the Lord is not ſhortened. In all this prevalency of atheiſm and irreligion, there is no advantage gained by the powers of darkneſs, either againſt God, or godly men, but only againſt their own wretched partiſans. The chriſtian diſpenſation is a diſpenſation of grace and favour. The chriſtian church a ſociety of men intitled to this grace, on performing certain conditions. If this ſociety

is diminiſhed, as thoſe who remain true members of it ſuffer no loſs to themſelves, ſo God loſeth no right, ſuffereth no detriment, forgoeth no good; his grace reſiſted or unfruitful, being no more loſt to him, than the light of the ſun ſhining on deſart places, or among people who ſhut their eyes.

Beſides, this exceſs, this unſtemmed torrent of profaneneſs, may poſſibly, in the concluſion, defeat itſelf, confirm what it meant to extirpate, and inſtead of deſtroying, prove a means of preſerving our religion; the evil fruits and effects thereof being ſo notorious and flagrant, and ſo ſenſily felt, as in all likelihood to be able to open the eyes, and rouſe the attention of thoſe, who may be blind and deaf to every other argument and conſideration. Or, who knows but the chriſtian church corrupted by proſperity, is to be reſtored and purified by adverſity? which may prove for ought we can tell, as ſalutary in future, as it hath been in paſt ages. Many inſolent and preſumptuous foes have ſet themſelves againſt the church of God; whoſe hook nevertheleſs may be in their noſtrils, and his bridle in their lips, managing and governing, even their rage and folly, to the fulfilling of his own wiſe purpoſes; and who may not fail in the end, to deal by them as he did by the king of *Aſſyria*, when he had * *performed his work upon Sion and upon Jeruſalem, puniſhing their ſtout heart and high looks.* This preſumptuous conqueror was, without knowing it, a tool or inſtrument in the hands of that God whom he blaſphemed. † *O Aſſyrian, the rod of mine anger! I will ſend him againſt an hypocritical nation, and againſt the people of my wrath will I give him a charge to take the ſpoil, and to take the prey, and to tread them down like the mire of the ſtreets. Howbeit he meaneth not ſo, neither doth his heart think ſo, but it is in his heart to deſtroy and cut off nations not a few.*

* Iſa. x. 12. † Iſa. x. 5, 6, 7.

Thus

Thus much at leaſt is evident: it is no new thing, that great enormities ſhould produce great humiliations, and theſe again noble virtues, which have often recovered both ſingle men, and whole ſtates, even in a natural and civil ſenſe. And if the captivities, diſtreſſes, and deſolations of the Jewiſh Church, have occaſioned their return to God, and reinſtated them in his favour; nay, if it was actually foretold, whenever they lay under the curſe of God, at the mercy of their enemies, peeled and ſcattered in a foreign land, that nevertheleſs upon their calling his covenant to mind, and returning to him, * *the Lord their God would turn their captivity, and have compaſſion upon them.* I ſay, if things were ſo, why may we not in reaſon hope for ſomething analogous thereto, in behalf of the chriſtian church. It cannot be denied, that there was a great analogy between the Jewiſh inſtitutions, and the doctrines of the goſpel; for inſtance, between the Paſchal Lamb, and the Lamb of God ſlain from the foundation of the world; between the *Egyptian* bondage, and that of ſin; the earthly *Canaan*, and the heavenly; the fleſhly circumciſion, and the ſpiritual. In theſe and many other particulars, the analogy ſeems ſo plain, that it can hardly be diſputed. To be convinced that the law of *Moſes*, and the Jewiſh œconomy were figures and ſhadows of the evangelical, we need only look into the epiſtle to the *Hebrews*. May we not therefore, in purſuance of this ſame analogy, ſuppoſe a ſimilar treatment of the Jewiſh and chriſtian church?

Let us then ſee, on what terms the former ſtood with God, in order to diſcover what the latter may reaſonably expect. The ſolemn denunciation to the Jews was, † *If thou ſhalt hearken diligently unto the voice of the Lord thy God, to obſerve and to do all his commandments, which I command thee this day, that the Lord thy God will ſet thee on high above all the nations of the earth.* But in caſe of diſobedience, it is added among many other threats and maledictions: ‡ *The Lord ſhall ſmite thee with blaſt-*

* Deut. xxx. 3. † Deut. xxviii. 1. ‡ Ver. 22, 23.

ing

ing and with mildew: and thy heaven that is over thy head ſhall be braſs, and the earth that is under thee ſhall be iron. And again, * *The Lord ſhall ſmite thee with madneſs, and blindneſs, and aſtoniſhment of heart.* Have not the people of this land drawn down upon it, by more ways than one, the juſt judgments of heaven? Surely we have felt in a metaphor the firſt of the forementioned judgments; and the laſt hath been literally fulfilled upon us. Is it not viſible that we are leſs knowing, leſs virtuous, leſs reaſonable, in proportion as we are leſs religious? Are we not grown drunk and giddy with vice and vanity and preſumption, and free-thinking, and extravagance of every kind? to a degree that we may truly be ſaid to be *ſmitten with madneſs, and blindneſs, and aſtoniſhment of heart.*

As anciently moſt unchriſtian ſchiſms and diſputes, joined with great corruption of manners, made way for the Mahometan in the eaſt, and the papal dominion in the weſt; even ſo here at home in the laſt century, a weak reliance upon human politics and power on the one hand, and enthuſiaſtic rage on the other, together with carnal mindedneſs on both, gave occaſion to introduce atheiſm and infidelity. If the temporal ſtate, and outward form of the Jewiſh church was, upon their defection, overturned by invaders; in like manner, when chriſtians are no longer governed by the light of evangelical truth, when we reſiſt the Spirit of God, are we not to expect, that *the heaven above will be as braſs*, that the divine grace will no longer ſhower down on our obdurate hearts, that our church and profeſſion will be blaſted by licentious ſcorners, thoſe madmen, who in ſport *ſcatter firebrands, arrows and death?* As all this is no more than we may reaſonably ſuppoſe will enſue upon our backſliding, ſo we may, with equal reaſon, hope it will be remedied upon our return to God.

* Deut. xxviii. 28.

From

From what hath been ſaid it follows, that in order to propagate the goſpel abroad, it is neceſſary we do it at home, and extend our charity to domeſtic infidels, if we would convert or prevent foreign ones. So that a view of the declining ſtate of religion here at home, of thoſe things that produced this declenſion, and of the proper methods to repair it, is naturally connected with the ſubject of this diſcourſe. I ſhall therefore beg your patience, while I juſt mention a few remarks or hints, too obvious, perhaps, in themſelves to be new or unknown to any preſent, but too little viſible in their effects, to make one think they are, by all, much attended to.

Some, preferring points notional or ritual to the love of God and man, conſider the national church only as it ſtands oppoſed to other chriſtian ſocieties. Theſe generally have a zeal without knowledge, and the effects are ſuitable to the cauſe; they really hurt what they ſeem to eſpouſe. Others more ſolicitous about the diſcovery of truth, than the practice of holineſs, employ themſelves, rather to ſpy out errors in the church, than enforce its precepts. Theſe, it is to be feared, poſtpone the great intereſts of religion to points of leſs concern, in any eyes but their own. But ſurely they would do well to conſider, that an humble, though confuſed or indiſtinct faith in the bond of charity, and productive of good works, is much more evangelical than any accurate diſputing and conceited knowledge.

A church which contains the fundamentals, and nothing ſubverſive of thoſe fundamentals, is not to be ſet at naught by any particular member; becauſe it may not, in every point, perhaps, correſpond with his ideas, no not, though he is ſure of being in the right. Probably there never was, or will be, an eſtabliſhed church in this world, without viſible marks of humanity upon it. St. *Paul* ſuppoſeth, that * *on the foundation of Jeſus*

* 1 Cor. iii. 12.

Chriſt,

Chriſt, there will be human ſuperſtructures of hay and ſtubble, things light and trivial, wrong or ſuperſtitious, which indeed is a natural conſequence of the weakneſs and ignorance of man. But where that living foundation is rightly laid in the mind, there will not fail to grow and ſpring from thence thoſe virtues and graces, which are the genuine effects and tokens of true faith, and which are by no means inconſiſtent with every error in theory, or every needleſs rite in worſhip.

The chriſtian religion was calculated for the bulk of mankind, and therefore cannot reaſonably be ſuppoſed to conſiſt in ſubtle and nice notions. From the time that divinity was conſidered as a ſcience, and human reaſon enthroned in the ſanctuary of God, the hearts of its profeſſors ſeem to have been leſs under the influence of grace. From that time have grown many unchriſtian diſſentions and controverſies, of men * *knowing nothing, but doating about queſtions and ſtrifes of words, whereof cometh envy, ſtrife, railings, evil ſurmiſes, perverſe diſputings of men of corrupt minds and deſtitute of truth.* Doubtleſs, the making religion a notional thing, hath been of infinite diſſervice. And whereas its holy myſteries are rather to be received with humility of faith, than defined and meaſured by the accuracy of human reaſon; all attempts of this kind, however well intended, have viſibly failed in the event; and inſtead of reconciling infidels, have, by creating diſputes and heats among the profeſſors of chriſtianity, given no ſmall advantage to its enemies.

To conclude, if we proportioned our zeal to the importance of things: if we could love men whoſe opinions we do not approve: if we knew the world more, and liked it leſs: if we had a due ſenſe of the divine perfection and our own defects: if our chief ſtudy was the wiſdom from above, deſcribed by St. *Paul:* and if, in order to all this, that were done

* 1 Tim. vi. 4, 5.

in

in places of education, which cannot ſo well be done out of them: I ſay, if theſe ſteps were taken at home, while proper meaſures are carrying on abroad, the one would very much forward or facilitate the other. As it is not meant, ſo it muſt not be underſtood, that foreign attempts ſhould wait for domeſtic ſucceſs, but only that it is to be wiſhed they may co-operate. Certainly if a juſt and rational, a genuine and ſincere, a warm and vigorous piety, animated the mother-country, the influence thereof would ſoon reach our foreign plantations, and extend throughout their borders. We ſhould ſoon ſee religion ſhine forth with new luſtre and force, to the converſion of infidels, both at home and abroad, and to * *the caſting down imaginations, and every high thing that exalteth itſelf againſt the knowledge of God, and bringing into captivity every thought to the obedience of Chriſt.*

To whom with the FATHER, and the HOLY GHOST, be aſcribed all praiſe, might, majeſty, and dominion, now and for ever.

* 2 Cor. x. 5.

SIRIS:

A CHAIN OF

PHILOSOPHICAL REFLECTIONS

AND

INQUIRIES

Concerning the VIRTUES of

TAR WATER,

And divers other SUBJECTS connected together and arising one from another.

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S I R I S.

FOR INTRODUCTION to the following piece I aſſure the reader, that nothing could, in my preſent ſituation, have induced me to be at the pains of writing it, but a firm belief that it would prove a valuable preſent to the public. What entertainment ſoever the reaſoning or notional part may afford the mind, I will venture to ſay, the other part ſeemeth ſo ſurely calculated to do good to the body, that both muſt be gainers. For if the lute be not well tuned, the muſician fails of his harmony. And in our preſent ſtate, the operations of the mind, ſo far depend on the right tone or good condition of its inſtrument, that any thing which greatly contributes to preſerve or recover the health of the body, is well worth the attention of the mind. Theſe conſiderations have moved me to communicate to the public the ſalutary virtues of tar water; to which I thought myſelf indiſpenſably obliged, by the duty every man owes to mankind. And, as effects are linked with their cauſes, my thoughts on this low but uſeful theme led to farther inquiries, and thoſe on to others remote, perhaps, and ſpeculative, but, I hope, not altogether uſeleſs or unentertaining.

1. In certain parts of America, tar water is made by putting a quart of cold water to a quart of tar, and ſtirring them well together in a veſſel, which is left ſtanding till the tar ſinks to the bottom. A glaſs of water being poured off for a draught, is replaced by the ſame quantity of freſh water, the veſſel being ſhaken and left to ſtand as before. And this is

repeated for every glaſs, ſo long as the tar continues to impregnate the water ſufficiently, which appears by the ſmell and taſte. But as this method produceth tar water of a nauſeous kind, and different degrees of ſtrength, I chuſe to make it in the following manner. Pour a gallon of cold water on a quart of tar, and ſtir, work and mix them thoroughly together with a wooden ladle or flat ſtick, for the ſpace of five or ſix minutes; after which the veſſel muſt ſtand cloſe covered and unmoved three days and nights, that the tar may have full time to ſubſide; and then the clear water, having been firſt carefully ſkimmed without ſhaking the veſſel, is to be poured off, and kept in bottles well ſtopped for uſe *, no more being made from the ſame tar, which may ſtill ſerve for common uſes.

2. The cold infuſion of tar hath been uſed in ſome of our colonies, as a preſervative or preparative againſt the ſmall-pox, which foreign practice induced me to try it in my own neighbourhood, when the ſmall-pox raged with great violence. And the trial fully anſwered my expectation: all thoſe, within my knowledge, who took the tar water having either eſcaped that diſtemper, or had it very favourably. In one family there was a remarkable inſtance of ſeven children, who came all very well through the ſmall-pox, except one young child which could not be brought to drink tar water as the reſt had done.

3. Several were preſerved from taking the ſmall-pox by the uſe of this liquor: others had it in the mildeſt manner, and others that they might be able to take the infection, were obliged to intermit drinking the tar water. I have found it may be drunk with great ſafety and ſucceſs for any length of time, and this not only before, but alſo during the

* I make this water ſtronger, than that firſt preſcribed in SIRIS, having found on more general experience, that five or ſix minutes ſtirring, when the water is carefully cleared and ſkimmed, agrees with moſt ſtomachs.

diſtemper.

diſtemper. The general rule for taking it is, about half a pint night and morning on an empty ſtomach, which quantity may be varied, according to the caſe and age of the patient, provided it be always taken on an empty ſtomach, and about two hours before or after a meal. For children and ſqueamiſh perſons it may be made weaker or given little and often, more water or leſs ſtirring makes it weaker, as leſs water or more ſtirring makes it ſtronger. It ſhould not be lighter than French, nor deeper coloured than Spaniſh white wine; if a ſpirit be not very ſenſibly perceived on drinking, either the tar muſt have been bad or already uſed, or the tar water careleſly made or kept. Particular experience will beſt ſhew how much and how ſtrong the ſtomach can bear, and what are the propereſt times for taking it. I apprehend no danger from exceſs in the uſe of this medicine.

4. It ſeemed probable, that a medicine of ſuch efficacy in a diſtemper attended with ſo many purulent ulcers, might be alſo uſeful in other foulneſſes of the blood, accordingly I tried it on ſeveral perſons infected with cutaneous eruptions and ulcers, who were ſoon relieved, and ſoon after cured. Encouraged by theſe ſucceſſes, I ventured to adviſe it in the fouleſt diſtempers, wherein it proved much more ſucceſsful than ſalivations and wood drinks had done.

5. Having tried it in a great variety of caſes, I found it ſucceeded beyond my hopes; in a tedious and painful ulceration of the bowels, in a conſumptive cough and (as appeared by expectorated pus) an ulcer in the lungs; in a pleuriſy and peripneumony. And when a perſon who for ſome years had been ſubject to eryſipelatous fevers, perceived the uſual fore-running ſymptoms to come on. I adviſed her to drink tar water, which prevented the eryſipelas.

6. I never knew any thing ſo good for the ſtomach as tar water: it cures indigeſtion and gives a good appetite. It is an excellent medicine in an aſthma. It imparts a kindly warmth and quick circulation to the juices without heating, and is therefore uſeful, not only as a pectoral and balſamic, but alſo as a powerful and ſafe deobſtruent in cachectic and hyſteric caſes. As it is both healing and diuretic, it is very good for the gravel. I believe it to be of great uſe in a dropſy, having known it cure a very bad anarſaca in a perſon whoſe thirſt, though very extraordinary, was in a ſhort time removed by the drinking of tar water.

7. The uſefulneſs of this medicine in inflammatory caſes is evident, from what has been already obſerved *. And yet ſome perhaps may ſuſpect that, as the tar itſelf is ſulphureous, tar water muſt be of a hot and inflaming nature. But it is to be noted that all balſams contain an acid ſpirit, which is in truth a volatile ſalt. Water is a menſtruum that diſſolves all ſorts of ſalts, and draws them from their ſubjects. Tar, therefore, being a balſam, its ſalutary acid is extracted by water, which yet is incapable of diſſolving its groſs reſinous parts, whoſe proper menſtruum is ſpirit of wine. Therefore tar water, not being impregnated with reſin, may be ſafely uſed in inflammatory caſes: and in fact it hath been found an admirable febrifuge, at once the ſafeſt cooler and cordial.

8. The volatile ſalts ſeparated by infuſion from tar, may be ſuppoſed to contain its ſpecific virtues. Mr. Boyle and other later chymiſts are agreed, that fixed ſalts are much the ſame in all bodies. But it is well known that volatile ſalts do greatly differ, and the eaſier they are ſeparated from the ſubject, the more do they poſſeſs of its ſpecific qualities. Now the moſt eaſy ſeparation is by infuſion of tar in cold water, which to ſmell and taſte ſhewing itſelf well impregnated, may be preſumed to

* Sect. 5.

extract

extract and retain the moſt pure volatile and active particles of that vegetable balſam.

9. Tar was by the ancients eſteemed good againſt poiſons, ulcers, the bites of venomous creatures, alſo for phthiſical, ſcrofulous, paralitic and aſthmatic perſons. But the method of rendering it an inoffenſive medicine and agreeable to the ſtomach, by extracting its virtues in cold water, was unknown to them. The leaves and tender tops of pine and fir are in our times uſed for diet drinks, and allowed to be antiſcorbutic and diuretic. But the moſt elaborate juice, ſalt, and ſpirit of theſe evergreens are to be found in tar; whoſe virtues extend not to animals alone, but alſo to vegetables. Mr. Evelyn in his treatiſe on foreſt trees obſerves with wonder, that ſtems of trees, ſmeared over with tar, are preſerved thereby from being hurt by the envenomed teeth of goats and other injuries, while every other thing of an unctuous nature is highly prejudicial to them.

10. It ſeems that tar and turpentine may be had more or leſs, from all ſorts of pines and firs whatſoever; and that the native ſpirits and eſſential ſalts of thoſe vegetables are the ſame in turpentine and common tar. In effect this vulgar tar, which cheapneſs and plenty may have rendered contemptible, appears to be an excellent balſam, containing the virtues of moſt other balſams, which it eaſily imparts to water, and by that means readily and inoffenſively inſinuates them into the habit of the body.

11. The reſinous exſudations of pines and firs are an important branch of the *materia medica*, and not only uſeful in the preſcriptions of phyſicians, but have been alſo thought otherwiſe conducive to health. Pliny tells us, that wines in the time of the old Romans were medicated with pitch and reſin; and Jonſtonus in his *Dendrographia* obſerves, that it is wholeſome to walk in groves of pine trees, which impregnate the air with balſamic

balſamic particles. That all turpentines and reſins are good for the lungs, againſt gravel alſo and obſtructions, is no ſecret. And that the medicinal properties of thoſe drugs are found in tar water, without heating the blood, or diſordering the ſtomach, is confirmed by experience; and particularly, that phthiſical and aſthmatic perſons receive ſpeedy and great relief from the uſe of it.

12. Balſams, as all unctuous and oily medicines, create a nauſeating in the ſtomach. They cannot therefore be taken in ſubſtance, ſo much or ſo long, as to produce all thoſe ſalutary effects, which, if thoroughly mixed with the blood and juices, they would be capable of producing. It muſt therefore be a thing of great benefit, to be able to introduce any requiſite quantity of their volatile parts into the fineſt ducts and capillaries, ſo as not to offend the ſtomach, but, on the contrary to comfort and ſtrengthen it in a great degree.

13. According to Pliny, liquid pitch (as he calls it) or tar, was obtained by ſetting fire to billets of old fat pines or firs. The firſt running was tar, the later or thicker running was pitch. Theophraſtus is more particular: he tells us the Macedonians made huge heaps of the cloven trunks of thoſe trees, wherein the billets were placed erect beſide each other. That ſuch heaps or piles of wood were ſometimes a hundred and eighty cubits round, and ſixty or even a hundred high: and that having covered them with ſods of earth to prevent the flame from burſting forth (in which caſe the tar was loſt) they ſet on fire thoſe huge heaps of pine or fir, letting the tar and pitch run out in a channel.

14. Pliny ſaith, it was cuſtomary for the ancients, to hold fleeces of wool over the ſteam of boiling tar, and ſqueeze the moiſture from them, which watery ſubſtance was called piſſinum. Ray will have this to be the ſame with the piſſelæum of the ancients; but Hardouin in his notes on

on Pliny, thinks the piſſelæum to have been produced from the cones of cedars. What uſe they made of theſe liquors anciently I know not: but it may be preſumed they were uſed in medicine, though at preſent, for ought I can find, they are not uſed at all.

15. From the manner of procuring tar * it plainly appears to be a natural production, lodged in the veſſels of the tree whence it is only freed and let looſe (not made) by burning. If we may believe Pliny, the firſt running or tar was called cedrium, and was of ſuch efficacy to preſerve from putrefaction, that in Ægypt they embalmed dead bodies with it. And to this he aſcribes their mummies continuing uncorrupted for ſo many ages.

16. Some modern writers inform us that tar flows from the trunks of pines and firs, when they are very old, through inciſions made in the bark near the root. That pitch is tar inſpiſſated: and both are the oil of the tree grown thick and ripened with age and ſun. The trees, like old men, being unable to perſpire, and their ſecretory ducts obſtructed, they are, as one may ſay, choaked and ſtuffed with their own juice.

17. The method uſed by our colonies in America, for making tar and pitch, is in effect the ſame with that of the ancient Macedonians; as appears from the account given in the philoſophical tranſactions. And the relation of Leo Africanus who deſcribes, as an eye witneſs, the making of tar on mount Atlas, agrees in ſubſtance, with the methods uſed by the Macedonians of old, and the people of New England at this day.

18. Jonſtonius in his *Dendrographia*, is of opinion, that pitch was anciently made of cedar, as well as of the pine and fir grown old and oily. It ſhould ſeem indeed that one and the ſame word was uſed by the anci-

* Sect. 13.

ents.

ents in a large ſenſe, ſo as to comprehend the juices iſſuing from all thoſe trees. Tar and all ſorts of exſudations from evergreens are, in a general acceptation, included under the name reſin. Hard coarſe reſin or dry pitch is made from tar, by letting it blaze till the moiſture is ſpent. Liquid reſin is properly an oily viſcid juice oozing from the bark of evergreen trees, either ſpontaneouſly or by inciſion. It is thought to be the oil of the bark inſpiſſated by the ſun. As it iſſues from the tree it is liquid, but becomes dry and hard being condenſed by the ſun or by fire.

19. According to Theophraſtus, reſin was obtained by ſtripping off the bark from pines, and by inciſions made in the ſilver fir and the pitch pine. The inhabitants of mount Ida, he tell us, ſtripped the trunk of the pine on the ſunny ſide two or three cubits from the ground. He obſerves that a good pine might be made to yield reſin every year; an indifferent every other year, and the weaker trees once in three years; and that three runnings were as much as a tree could bear. It is remarkable by the ſame author, that a pine doth not at once produce fruit and reſin, but the former only in its youth, the latter in its old age.

20. Turpentine is a fine reſin. Four kinds of this are in uſe. The turpentine of chios or cyprus which flows from the turpentine tree; the venice turpentine which is got by piercing the larch tree; the Straſburgh turpentine which Mr. Ray informs us is procured from the knots of the ſilver fur; it is fragrant and grows yellow with age; the fourth kind is common turpentine, neither tranſparent nor ſo liquid as the former; and this Mr. Ray taketh to flow from the mountain pine. All theſe turpentines are uſeful in the ſame intentions. Theophraſtus ſaith the beſt reſin or turpentine is got from the terebinthus growing in Syria and ſome of the Greek iſlands. The next beſt from the ſilver fir and pitch pine.

21. Tur-

21. Turpentine is on all hands allowed to have great medicinal virtues. Tar and its infuſion contain thoſe virtues. Tar water is extremely pectoral and reſtorative, and if I may judge, from what experience I have had, it poſſeſſeth the moſt valuable qualities aſcribed to the ſeveral balſams of Peru, of Tolu, of Capivi and even to the balm of Gilead, ſuch is its virtue in aſthmas and pleuriſies, in obſtructions and ulcerous eroſions of the inward parts. Tar in ſubſtance mixed with honey I have found an excellent medicine for coughs. Balſams as hath been already obſerved are apt to offend the ſtomach. But tar water may be taken without offending the ſtomach. For the ſtrengthening whereof it is the beſt medicine I have ever tried.

22. The folly of man rateth things by their ſcarceneſs, but Providence hath made the moſt uſeful things moſt common. Among thoſe liquid oily extracts from trees and ſhrubs, which are termed balſams, and valued for medicinal virtues, tar may hold its place as a moſt valuable balſam. Its fragrancy ſheweth, that it is poſſeſſed of active qualities, and its oilineſs, that it is fitted to retain them. This excellent balſam may be purchaſed for a penny a pound, whereas the balſam of Judea, when moſt plenty, was ſold on the very ſpot that produced it, for double its weight in ſilver, if we may credit Pliny; who alſo informs us that the beſt balſam of Judea flowed only from the bark, and that it was adulterated with reſin and oil of turpentine. Now comparing the virtues I have experienced in tar, with thoſe I find aſcribed to the precious balm of Judea, of Gilead, or of Mecha (as it is diverſly called) I am of opinion, that the latter is not a medicine of more value or efficacy than the former.

23. Pliny ſuppoſed amber to be a reſin, and to diſtil from ſome ſpecies of pine, which he gathered from its ſmell. Nevertheleſs its being dug out of the earth ſhews it to be a foſſil, though of a very different

kind from other foſſils. But thus much is certain, that the medicinal virtues of amber are to be found in the balſamic juices of pines and firs. Particularly the virtues of the moſt valuable preparation, I mean ſalt of amber, are in a great degree anſwered by tar water, as a detergent, diaphoretic, and diuretic.

24. There is, as hath been already obſerved, more or leſs oil and balſam in all evergreen trees, which retains the acid ſpirit, that principle of life and verdure; the not retaining whereof in ſufficient quantity, cauſeth other plants to droop and wither. Of theſe evergreen trees productive of reſin, pitch, and tar, Pliny enumerates ſix kinds in Europe; Jonſtonus reckons up thrice that number of the pine and fir family. And indeed, their number, their variety, and their likeneſs makes it difficult to be exact.

25. It is remarked both by Theophraſtus and Jonſtonus, that trees growing in low and ſhady places do not yield ſo good tar, as thoſe which grow in higher and more expoſed ſituations. And Theophraſtus further obſerves, that the inhabitants of mount Ida in Aſia, who diſtinguiſh the Idæan pine from the maritime, affirm, that the tar flowing from the former is in greater plenty, as well as more fragrant than the other. Hence it ſhould ſeem, the pines or firs in the mountains of Scotland, might be employed that way, and rendered valuable; even where the timber, by its remoteneſs from water carriage, is of ſmall value. What we call the Scotch fir is falſely ſo called, being in truth a wild foreſt pine, and (as Mr. Ray informs us) agreeing much with the deſcription of a pine growing on mount Olympus in Phrygia, probably the only place where it is found out of theſe iſlands; in which of late years it is ſo much planted and cultivated with ſo little advantage, while the cedar of Lebanon might perhaps be raiſed, with little more trouble, and much more profit and ornament.

26. The

26. The pines, which differ from the firs in the length and diſpoſition of their leaves and hardneſs of the wood, do not in Pliny's account, yield ſo much reſin as the fir trees. Several ſpices of both are accurately deſcribed and delineated by the naturaliſts. But they all agree ſo far as to ſeem related. Theophraſtus gives the preference to that reſin which is got from the ſilver fir and pitch tree (ἐλατη and πιτυς) before that yielded by the pine, which yet he ſaith is in greater plenty. Pliny, on the contrary, affirms that the pine produceth the ſmalleſt quantity. It ſhould ſeem therefore that the interpreter of Theophraſtus might have been miſtaken, in rendering πίυκη by pinus, as well as Jonſtonus, who likewiſe takes the pine for the πίυκη of Theophraſtus. Hardouin will have the pinus of Pliny to have been by others called πίυκη, but by Theophraſtus πιτυς. Ray thinks the common fir, or picea of the Latins to be the male fir of Theophraſtus. This was probably the ſpruce fir; for the picea according to Pliny, yields much reſin, loves a cold and mountainous ſituation, and is diſtinguiſhed, tonſili facilitate, by its fitneſs to be ſhorn, which agrees with the ſpruce fir, whereof I have ſeen cloſe ſhorn hedges.

27. There ſeems to have been ſome confuſion in the naming of theſe trees, as well among the ancients as the moderns. The ancient Greek and Latin names are by later authors applied very differently. Pliny himſelf acknowledgeth, it is not eaſy even for the ſkilful to diſtinguiſh the trees by their leaves, and know their ſexes and kinds: and that difficulty is ſince much increaſed, by the diſcovery of many new ſpecies of that ever green tribe, growing in various parts of the globe. But deſcriptions are not ſo eaſily miſapplied as names. Theophraſtus tells, that πιτυς differeth from πίυκη, among other things, in that it is neither ſo tall nor ſo ſtraight, nor hath ſo large a leaf. The fir he diſtinguiſheth into male and female: the latter is ſofter timber than the male, it is alſo a taller and fairer tree, and this is probably the ſilver fir.

28. To ſay no more on this obſcure buſineſs which I leave to the criticks, I ſhall obſerve that according to Theophraſtus not only the turpentine trees, the pines, and the firs yield reſin or tar, but alſo the cedars and palm trees; and the words *pix* and *reſina* are taken by Pliny in ſo large a ſenſe as to include the weepings of the Lentiſcus and Cypreſs, and the balms of Arabia and Judæa; all which perhaps are near of kin, and in their moſt uſeful qualities concur with common tar, eſpecially the Norwegian, which is the moſt liquid and beſt for medicinal uſes of any that I have experienced. Thoſe trees that grow on mountains, expoſed to the ſun or the North wind, are reckoned by Theophraſtus to produce the beſt and pureſt tar: and the Idæan pines were diſtinguiſhed from thoſe growing on the plain, as yielding a thinner, ſweeter, and better ſcented tar, all which differences I think I have obſerved, between the tar that comes from Norway, and that which comes from low and ſwampy countries.

29. Agreeable to the old obſervation of the Peripatetics, that heat gathereth homogenous things and diſperſeth ſuch as are heterogeneous, we find chymiſtry is fitted for the analyſis of bodies. But the chymiſtry of nature is much more perfect than that of human art, inaſmuch as it joineth to the power of heat that of the moſt exquiſite mechaniſm. Thoſe who have examined the ſtructure of trees and plants by microſcopes, have diſcovered an admirable variety of fine capillary tubes and veſſels, fitted for ſeveral purpoſes, as the imbibing or attracting of proper nouriſhment, the diſtributing thereof through all parts of the vegetable, the diſcharge of ſuperfluities, the ſecretion of particular juices. They are found to have ducts anſwering to the tracheæ in animals, for the conveying of air; they have others anſwering to lacteals, arteries and veins. They feel, digeſt, reſpire, perſpire and generate their kind, and are provided with organs nicely fitted for all thoſe uſes.

30. The

30. The ſap veſſels are obſerved to be fine tubes running up through the trunk from the root. Secretory veſſels are found in the bark, buds, leaves, and flowers. Exhaling veſſels, for carrying off excrementitious parts, are diſcovered throughout the whole ſurface of the vegetable. And (though this point be not ſo well agreed) Dr. Grew in his anatomy of plants, thinks there appears a circulation of the ſap, moving downwards in the root, and feeding the trunk upwards.

31. Some difference indeed there is between learned men, concerning the proper uſe of certain parts of vegetables. But, whether the diſcoverers have rightly gueſſed at all their uſes or no, thus much is certain, that there are innumerable fine and curious parts in a vegetable body, and a wonderful ſimilitude or analogy between the mechaniſm of plants and animals. And perhaps ſome will think it not unreaſonable to ſuppoſe the mechaniſm of plants more curious than even that of animals, if we conſider not only the ſeveral juices ſecreted by different parts of the ſame plant, but alſo the endleſs variety of juices drawn and formed out of the ſame ſoil, by various ſpecies of vegetables; which muſt therefore differ in an endleſs variety, as to the texture of their abſorbent veſſels and ſecretory ducts.

32. A body, therefore, either animal or vegetable may be conſidered as an organized ſyſtem of tubes and veſſels, containing ſeveral ſorts of fluids. And as fluids are moved through the veſſels of animal bodies, by the ſyſtole aud diaſtole of the heart, the alternate expanſion and condenſation of the air, and the oſcillations in the membranes and tunicks of the veſſels; even ſo by means of air expanded and contracted in the tracheæ or veſſels made up of elaſtic fibres, the ſap is propelled through the arterial tubes of a plant, and the vegetable juices, as they are rarefied by heat or condenſed by cold, will either aſcend and evaporate into air, or deſcend in the form of a groſs liquor.

33. Juices

33. Juices therefore, firſt purified by ſtraining through the fine pores of the root, are afterwards exalted by the action of the air and veſſels of the plant, but, above all, by the action of the ſun's light; which at the ſame time that it heats, doth wonderfully rarefy and raiſe the ſap; till it perſpires and forms an atmoſphere, like the effluvia of animal bodies. And though the leaves are ſuppoſed to perform principally the office of lungs, breathing out excrementitious vapours and drawing in alimentary; yet it ſeems probable, that the reciprocal actions of repulſion and attraction, are performed all over the ſurface of vegetables, as well as animals. In which reciprocation, Hippocrates ſuppoſeth the manner of nature's acting, for the nouriſhment and health of animal bodies chiefly to conſiſt. And, indeed, what ſhare of a plant's nouriſhment is drawn through the leaves and bark, from that ambient heterogeneous fluid called air, is not eaſy to ſay. It ſeems very conſiderable and altogether neceſſary, as well to vegetable as animal life.

34. It is an opinion received by many, that the ſap circulates in plants as the blood in animals: that it aſcends through capillary arteries in the trunk, into which are inoſculated other veſſels of the bark anſwering to veins, which bring back to the root the remainder of the ſap, over and above what had been depoſited, during its aſcent by the arterial veſſels, and ſecreted for the ſeveral uſes of the vegetable throughout all its parts, ſtem, branches, leaves, flowers, and fruit. Others deny this circulation, and affirm that the ſap doth not return through the bark veſſels. It is nevertheleſs agreed by all that there are aſcending and deſcending juices; while ſome will have the aſcent and deſcent to be a circulation of the ſame juices through different veſſels: others will have the aſcending juice to be one ſort attracted by the root, and the deſcending another imbibed by the leaves, or extremities of the branches: laſtly, others think that the ſame juice, as it is rarefied or condenſed by heat or cold, riſes and ſubſides in the ſame tube. I ſhall not take upon me to decide this controverſy.

controverſy. Only I cannot help obſerving, that the vulgar argument from analogy between plants and animals loſeth much of its force, if it be conſidered, that the ſuppoſed circulating of the ſap, from the root or lacteals through the arteries, and thence returning, by inoſculations, through the veins or bark veſſels to the root or lacteals again, is in no ſort conformable or analogous to the circulation of the blood.

35. It is ſufficient to obſerve, what all muſt acknowledge, that a plant or tree is a very nice and complicated machine *; by the ſeveral parts and motions whereof, the crude juices admitted through the abſorbent veſſels, whether of the root, trunk, or branches, are variouſly mixed, ſeparated, altered, digeſted, and exalted in a very wonderful manner. The juice as it paſſeth in and out, up and down, through tubes of different textures, ſhapes, and ſizes, and is affected by the alternate compreſſion and expanſion of elaſtic veſſels, by the viciſſitudes of ſeaſons, the changes of weather, and the various action of the ſolar light, grows ſtill more and more elaborate.

36. There is therefore no chymiſtry like that of nature, which addeth to the force of fire the moſt delicate, various and artifical percolation †. The inceſſant action of the ſun upon the elements of air, earth, and water, and on all ſorts of mixed bodies, animal, vegetable and foſſil, is ſuppoſed to perform all ſorts of chymical operations. Whence it ſhould follow that the air contains all ſorts of chymic productions, the vapours, fumes, oils, ſalts, and ſpirits of all the bodies we know: from which general aggregate or maſs, thoſe that are proper being drawn in, through the fine veſſels of the leaves, branches, and ſtem of the tree, undergo in its various organs, new alterations, ſecretions, and digeſtions, till ſuch time as they aſſume the moſt elaborate form.

* Sect. 30, 31. † 29.

37. Nor

37. Nor is it to be wondered, that the peculiar texture of each plant or tree, co-operating with the ſolar fire and pre-exiſting juices, ſhould ſo alter the fine nouriſhment drawn from earth and air *, as to produce various ſpecific qualities of great efficacy in medicine; eſpecially if it be conſidered that in the opinion of learned men, there is an influence on plants derived from the ſun, beſides its mere heat. Certainly Dr. Grew, that curious anatomiſt of plants, holds the ſolar influence to differ from that of a mere culinary fire, otherwiſe than by being only a more temperate and equal heat.

38. The alimentary juice taken into the lacteals, if I may ſo ſay, of vegetables, conſiſts of oily, aqueous, and ſaline particles, which being diſſolved, volatilized, and diverſly agitated, part thereof is ſpent and exhaled into the air; and that part which remains is by the œconomy of the plant, and action of the ſun, ſtrained, purified, concocted, and ripened into an inſpiſſated oil or balſam, and depoſited in certain cells placed chiefly in the bark, which is thought to anſwer the *panniculus adipoſus* in animals, defending trees from the weather, and, when in ſufficient quantity, rendering them evergreen. This balſam, weeping or ſweating through the bark, hardens into reſin; and this moſt copiouſly in the ſeveral ſpecies of pines and firs, whoſe oil being in greater quantity, and more tenacious of the acid ſpirit or vegetable ſoul (as perhaps it may not improperly be called) abides the action of the ſun, and attracting the ſun beams, is thereby exalted and enriched, ſo as to become a moſt noble medicine; ſuch is the laſt product of a tree, perfectly maturated by time and ſun.

39. It is remarked by Theophraſtus, that all plants and trees while they put forth have moſt humour, but when they have ceaſed to germinate and bear, then the humour is ſtrongeſt and moſt ſheweth the nature

* Sect. 33.

of

of the plant, and that, therefore, trees yielding reſin ſhould be cut after germination. It ſeems alſo very reaſonable to ſuppoſe the juice of old trees, whoſe organs bring no new ſap, ſhould be better ripened than that of others.

40. The aromatic flavours of vegetables ſeem to depend upon the ſun's light, as much as colours. As in the production of the latter, the reflecting powers of the object, ſo in that of the former, the attractive and organical powers of the plant cooperate with the ſun *. And as from Sir Iſaac Newton's experiments it appears, that all colours are virtually in the white light of the ſun, and ſhew themſelves when the rays are ſeparated by the attracting and repelling powers of objects, even ſo the ſpecific qualities of the elaborate juices of plants ſeem to be virtually or eminently contained in the ſolar light, and are actually exhibited upon the ſeparation of the rays, by the peculiar powers of the capillary organs in vegetables, attracting and imbibing certain rays, which produce certain flavours and qualities, in like manner as certain rays being reflected, produce certain colours.

41. It hath been obſerved by ſome curious anatomiſts, that the ſecretory veſſels in the glands of animal bodies are lined with a fine down, which in different glands is of different colours. And it is thought, that each particular down, being originally imbued with its own proper juice, attracts none but that ſort; by which means ſo many various juices are ſecreted in different parts of the body. And perhaps there may be ſomething analogous to this, in the fine abſorbent veſſels of plants, which may cooperate towards producing that endleſs variety of juices, elaborated in plants from the ſame earth and air.

42. The balſam or eſſential oil of vegetables contains a ſpirit, wherein conſiſt the ſpecific qualities, the ſmell and taſte of the plant. Boer-

* Sect. 36, 37.

haave holds the native preſiding ſpirit to be neither oil, ſalt, earth, or water; but ſomewhat too fine and ſubtile to be caught alone and rendered viſible to the eye. This when ſuffered to fly off, for inſtance, from the oil of roſemary, leaves it deſtitute of all flavour. This ſpark of life, this ſpirit or ſoul, if we may ſo ſay, of the vegetable departs without any ſenſible diminution of the oil or water wherein it was lodged.

43. It ſhould ſeem that the forms, ſouls, or principles of vegetable life, ſubſiſt in the light or ſolar emanation *, which in reſpect of the macrocoſm is what the animal ſpirit is to the microcoſm; the interior tegument, the ſubtile inſtrument and vehicle of power. No wonder then that the *ens primum* or *ſcintilla ſpirituoſa*, as it is called, of plants ſhould be a thing ſo fine and fugacious as to eſcape our niceſt ſearch. It is evident that nature at the ſun's approach vegetates; and languiſhes at his receſs; this terreſtial globe ſeeming only a matrix diſpoſed and prepared to receive life from his light; whence Homer in his hymns ſtyleth earth the wife of heaven, ἄλοχ', οὐρανῷ ἀστερόεντος.

44. The luminous ſpirit which is the form or life of a plant, from whence its differences and properties flow, is ſomewhat extremely volatile. It is not the oil, but a thing more ſubtile whereof oil is the vehicle, which retains it from flying off, and is lodged in ſeveral parts of the plant, particularly in the cells of the bark and in the ſeeds. This oil purified and exalted by the organical powers of the plant, and agitated by warmth, becomes a proper receptacle of the ſpirit; part of which ſpirit exhales through the leaves and flowers, and part is arreſted by this unctuous humour that detains it in the plant. It is to be noted this eſſential oil animated, as one may ſay, with the flavour of the plant is very different from any ſpirit, that can be procured from the ſame plant by fermentation.

* Sect. 40.

45. Light

45. Light impregnates air *, air impregnates vapour; and this becomes a watery juice by diſtillation having riſen firſt in the cold ſtill with a kindly gentle heat. This fragrant vegetable water is poſſeſſed of the ſpecific odour and taſte of the plant. It is remarked that diſtilled oils added to water for counterfeiting the vegetable water can never equal it, artificial chymiſtry falling ſhort of the natural.

46. The leſs violence is uſed to nature the better its produce. The juice of olives or grapes iſſuing by the lighteſt preſſure is beſt. Reſins that drop from the branches ſpontaneouſly, or ooze upon the ſlighteſt inciſion, are the fineſt and moſt fragrant. And infuſions are obſerved to act more ſtrongly than decoctions of plants, the more ſubtile and volatile ſalts and ſpirits, which might be loſt or corrupted by the latter, being obtained in their natual ſtate by the former. It is alſo obſerved that the fineſt, pureſt, and moſt volatile part is that which firſt aſcends in diſtillation. And, indeed, it ſhould ſeem the lighteſt and moſt active particles required leaſt force to diſengage them from the ſubject.

47. The ſalts, therefore, and more active ſpirits of the tar are got by infuſion in cold water: but the reſinous part is not to be diſſolved thereby †. Hence the prejudice which ſome perhaps may entertain againſt tar water, as a medicine, the uſe whereof might inflame the blood by its ſulphur and reſin, appears to be not well grounded; it being indeed impregnated with a fine acid ſpirit, balſamic, cooling, diuretic, and poſſeſſed of many other virtues ‡. Spirits are ſuppoſed to conſiſt of ſalts and phlegm, probably too ſomewhat of a fine oily nature, differing from oil in that it mixeth with water, and agreeing with oil, in that it runneth in rivulets by diſtillation. Thus much is allowed, that the water, earth, and fixed ſalt are the ſame in all plants; that, therefore, which differenceth a plant or makes it what it is, the native ſpark or form, in the

* Sect. 37, 43. † Sect. 7. ‡ Sect. 42, 44.

language of the chymiſts or ſchools, is none of thoſe things, nor yet the fineſt oil, which ſeemeth only its receptacle or vehicle. It is obſerved by chymiſts, that all ſorts of balſamic wood afford an acid ſpirit, which is the volatile oily ſalt of the vegetable: herein are chiefly contained their medicinal virtues, and by the trials I have made, it appears, that the acid ſpirit in tar water, poſſeſſeth the virtues, in an eminent degree, of that of guaiacum, and other medicinal woods.

48. Qualities in a degree too ſtrong for human nature to ſubdue, and aſſimilate to itſelf, muſt hurt the conſtitution. All acids, therefore, may not be uſeful or innocent. But this ſeemeth an acid ſo thoroughly concoct-ed, ſo gentle, bland, and temperate, and withal a ſpirit ſo fine and vola-tile, as readily to enter the ſmalleſt veſſels, and be aſſimilated with the utmoſt eaſe.

49. If any one were minded to diſſolve ſome of the reſin, together with the ſalt or ſpirit, he need only mix ſome ſpirit of wine with the water. But ſuch an entire ſolution of reſins and gums, as to qualify them for entering and pervading the animal ſyſtem, like the fine acid ſpirit, that firſt flies off from the ſubject, is perhaps impoſſible to obtain. It is an apothegm of the chymiſts, derived from Helmont, that whoever can make myrrh ſoluble by the human body, has the ſecret of prolonging his days: and Boerhaave owns that there ſeems to be truth in this, from its reſiſting putrefaction. Now this quality is as remarkable in tar, with which the antients embalmed and preſerved dead bodies. And though Boerhaave himſelf, and other chymiſts before him, have given methods for making ſolutions of myrrh, yet it is by means of alcohol which ex-tracts only the inflammable parts. And it doth not ſeem that any ſolution of myrrh is impregnated with its ſalt or acid ſpirit. It may not, therefore, ſeem ſtrange if this water ſhould be found more beneficial for procuring health and long life, than any ſolution of myrrh whatſoever.

50. Certainly

50. Certainly divers reſins and gums may have virtues, and yet not be able for their groſſneſs to paſs the lacteals and other finer veſſels, nor yet, perhaps, readily impart thoſe virtues to a *menſtruum*, that may with ſafety and ſpeed convey them throughout the human body. Upon all which accounts, I believe tar water will be found to have ſingular advantages. It is obſerved that acid ſpirits prove the ſtronger, by how much the greater degree of heat is required to raiſe them. And indeed, there ſeemeth to be no acid more gentle than this, obtained by the ſimple affuſion of cold water; which carries off from the ſubject the moſt light and ſubtile parts, and, if one may ſo ſpeak, the very flower of its ſpecific qualities. And here it is to be noted, that the volatile ſalt and ſpirit of vegetables do, by gently ſtimulating the ſolids, attenuate the fluids contained in them, and promote ſecretions, and that they are penetrating and active, contrary to the general nature of other acids.

51. It is a great maxim for health, that the juices of the body be kept fluid in a due proportion. Therefore, the acid volatile ſpirit in tar water, at once attenuating and cooling in a moderate degree, muſt greatly conduce to health, as a mild ſalutary deobſtruent, quickening the circulation of the fluids without wounding the ſolids, thereby gently removing or preventing thoſe obſtructions, which are the great and general cauſe of moſt chronical diſeaſes; in this manner anſwering to the antihyſterics, aſafœtida, galbanum, myrrh, amber, and in general, to all the reſins and gums of trees or ſhrubs uſeful in nervous caſes.

52. Warm water is itſelf a deobſtruent. Therefore the infuſion of tar drunk warm, is eaſier inſinuated into all the nice capillary veſſels, and acts, not only by virtue of the balſam, but alſo by that of the vehicle. Its taſte, its diuretic quality, its being ſo great a cordial, ſhew the activity of this medicine. And at the ſame time that it quickens the ſluggiſh blood of the hyſterical, its balſamic oily nature abates the too rapid motion

tion of the ſharp thin blood in thoſe who are hectic. There is a lentor and ſmoothneſs in the blood for healthy ſtrong people, on the contrary, there is often an acrimony and ſolution in that of weakly morbid perſons. The fine particles of tar are not only warm and active, they are alſo balſamic and emollient, ſoftening and enriching the ſharp and vapid blood, and healing the eroſions occaſioned thereby in the blood veſſels and glands.

53. Tar water poſſeſſeth the ſtomachic and cardiac qualities of elixir proprietatis, Stoughton's drops, and many ſuch tinctures and extracts, with this difference, that it worketh its effect more ſafely, as it hath nothing of that ſpirit of wine, which, however mixed and diſguiſed, may yet be well accounted a poiſon in ſome degree.

54. Such medicines are ſuppoſed to be diaphoretic, which being of an active and ſubtile nature, paſs thro' the whole ſyſtem, and work their effect in the fineſt capillaries and perſpiratory ducts, which they gently cleanſe and open. Tar water is extremely well fitted to work by ſuch an inſenſible diaphoreſis, by the fineneſs and activity of its acid volatile ſpirit. And ſurely thoſe parts ought to be very fine, which can ſcour the perſpiratory ducts, under the ſcarf ſkin or cuticle, if it be true that one grain of ſand would cover the mouths of more than a hundred thouſand.

55. Another way wherein tar water operates, is by urine, than which perhaps none is more ſafe and effectual, for cleanſing the blood and carrying off its ſalts. But it ſeems to produce its principal effect as an alterative, ſure and eaſy, much ſafer than thoſe vehement, purgative, emetic, and ſalivating medicines, which do violence to nature.

56. An

56. An obſtruction of ſome veſſels cauſeth the blood to move more ſwiftly in other veſſels, which are not obſtructed. Hence manifold diſorders. A liquor that dilutes and attenuates reſolves the concretions which obſtruct. Tar water is ſuch a liquor. It may be ſaid, indeed, of common water, that it attenuates, alſo of mercurial preparations that they attenuate. But it ſhould be conſidered that meer water only diſtends the veſſels and thereby weakens their tone; and that mercury by its great *momentum* may juſtly be ſuſpected of hurting the fine capillaries, which two deobſtruents therefore might eaſily overact their parts, and (by leſſening the force of the elaſtic veſſels) remotely produce thoſe concretions they are intended to remove.

57. Weak and rigid fibres are looked on by the moſt able phyſicians, as ſources of two different claſſes of diſtempers: a ſluggiſh motion of the liquids occaſions weak fibres: therefore tar water is good to ſtrengthen them as it gently accelerates their contents. On the other hand, being an unctuous bland fluid it moiſtens and ſoftens the dry and ſtiff fibres: and ſo proves a remedy for both extremes.

58. Common ſoaps are compoſitions of lixivial ſalt and oil. The corroſive acrimony of the ſaline particles, being ſoftened by the mixture of an unctuous ſubſtance they inſinuate themſelves into the ſmall ducts with leſs difficulty and danger. The combination of theſe different ſubſtances makes up a very ſubtile and active medicine, fitted for mixing with all humours, and reſolving all obſtructions. Soap therefore is juſtly eſteemed a moſt efficacious medicine in many diſtempers. Alcaline ſoap is allowed to be cleanſing, attenuating, opening, reſolving, ſweetening; it is pectoral, vulnerary, diuretic, and hath other good qualities which are alſo to be found in tar water. It is granted, that oil and acid ſalts combined together exiſt in vegetables, and that conſequently there are acid ſoaps as well as alcaline. And the ſaponaceous nature of the acid vegetable

table ſpirits, is what renders them ſo diuretic, ſudorific, penetrating, abſterſive and reſolving. Such, for inſtance, is the acid ſpirit of guaiacum. And all theſe ſame virtues ſeem to be in tar water in a mild and ſalutary degree.

59. It is the general opinion that all acids coagulate the blood. Boerhaave excepts vinegar which he holds to be a ſoap, inaſmuch as it is found to contain an oil as well as an acid ſpirit. Hence it is both unctuous and penetrating, a powerful antiphlogiſtic, and preſervative againſt corruption and infection. Now it ſeems evident that tar water is a ſoap as well as vinegar. For though it be the character of reſin, which is an inſpiſſated groſs oil, not to diſſolve in water*, yet the ſalts attract ſome fine particles of eſſential oil: which fine oil ſerves as a vehicle for the acid ſalts, and ſhews itſelf in the colour of the tar water: for all pure ſalts are colourleſs. And though the reſin will not diſſolve in water, yet the ſubtile oil, in which the vegetable ſalts are lodged, may as well mix with water as vinegar doth, which contains both oil and ſalt. And as the oil in tar water diſcovers itſelf to the eye, ſo the acid ſalts do manifeſt themſelves to the taſte. Tar water therefore is a ſoap and as ſuch hath the medicinal qualities of ſoaps.

60. It operates more gently as the acid ſalts loſe their acrimony being ſheathed in oil, and thereby approaching the nature of neutral ſalts, are more benign and friendly to the animal ſyſtem: and more effectually, as by the help of a volatile ſmooth inſinuating oil, thoſe ſame ſalts are more eaſily introduced into the capillary ducts. Therefore in fevers and epidemical diſtempers it is (and I have found it ſo) as well as in chronical diſeaſes, a moſt ſafe and efficacious medicine, being good againſt too great fluidity as a balſamic, and good againſt viſcidity as a ſoap. There is ſomething in the fiery corroſive nature of lixivial ſalts, which makes alcaline

* Sect. 47.

ſoap

ſoap a dangerous remedy in all caſes where an inflammation is apprehended. And as inflammations are often occaſioned by obſtructions, it ſhould ſeem an acid ſoap was much the ſafer deobſtruent.

61. Even the beſt turpentines, however famous for their vulnerary and detergent qualities, have yet been obſerved by their warmth to diſpoſe to inflammatory tumours. But the acid ſpirit * being in ſo great proportion in tar water renders it a cooler and ſafer medicine. And the etherial oil of turpentine though an admirable dryer, healer, and anodyne, when outwardly applied to wounds and ulcers, and not leſs uſeful in cleanſing the urinary paſſages and healing their ulcerations, yet is known to be of a nature ſo very relaxing as ſometimes to do much miſchief when taken inwardly. Tar water is not attended with the ſame ill effects, which I believe are owing in a great meaſure to the etherial oils being deprived of the acid ſpirit in diſtillation, which vellicating and contracting as a ſtimulus might have proved a counterpoiſe to the exceſſive lubricating and relaxing qualities of the oil.

62. Woods in decoction do not ſeem to yield ſo ripe and elaborate a juice, as that which is depoſited in the cells or *loculi terebinthiaci*, and ſpontaneouſly oozes from them. And indeed though the balſam of Peru obtained by boiling wood and ſcumming the decoction, be a very valuable medicine and of great account in divers caſes, particularly aſthmas, nephritic pains, nervous colics and obſtructions, yet I do verily think (and I do not ſay this without experience) that tar water is a more efficacious remedy in all thoſe caſes than even that coſtly drug.

63. It hath been already obſerved that the reſtorative pectoral antihyſterical virtues of the moſt precious balſams and gums are poſſeſſed in a high degree by tar water †. And I do not know any purpoſe anſwered

* Sect. 7, 8. † Sect. 9, 21, 22, 23.

by the wood drinks, for which tar water may not be uſed with at leaſt equal ſucceſs. It contains the virtues even of guaiacum which ſeems the moſt efficacious of all the woods, warming, and ſweetening the humours, diaphoretic and uſeful in gouts, dropſies and rheums, as well as in the foul diſeaſe. Nor ſhould it ſeem ſtrange, if the virtues obtained by boiling an old dry wood prove inferior to thoſe extracted from a balſam.

64. There is a fine volatile ſpirit in the waters of Geronſter, the moſt eſteemed of all the fountains about Spa, but whoſe waters do not bear tranſporting. The ſtomachic, cardiac and diuretic qualities of this fountain ſomewhat reſemble thoſe of tar water, which, if I am not greatly miſtaken, contains the virtues of the beſt chalybeat and ſulphureous waters; with this difference, that thoſe waters are apt to affect the head in taking, which tar water is not. Beſides, there is a regimen of diet to be obſerved, eſpecially with chalybeat waters, which I never found neceſſary with this. Tar water layeth under no reſtraint either as to diet, hours, or employment. A man may ſtudy or exerciſe or repoſe, keep his own hours, paſs his time either within or without, and take wholeſome nouriſhment of any kind.

65. The uſe of mineral waters, however excellent for the nerves and ſtomach, is often ſuſpended by colds and inflammatory diſorders; in which they are acknowledged to be very dangerous: whereas tar water is ſo far from hurting in thoſe caſes, or being diſcontinued on that account, that it greatly contributes to their cure *.

66. Cordials, vulgarly ſo called, act immediately on the ſtomach, and by conſent of nerves on the head. But medicines of an operation too fine and light to produce a ſenſible effect in the *primæ viæ*, may, nevertheleſs, in their paſſage through the capillaries, operate on the ſides of

* Sect. 7.

thoſe

thoſe ſmall veſſels, in ſuch manner as to quicken their oſcillations, and conſequently the motion of their contents, producing in iſſue and effect, all the benefits of a cordial much more laſting and ſalutary than thoſe of diſtilled ſpirits, which by their cauſtic and coagulating qualities do incomparably more miſchief than good. Such a cardaic medicine is tar water. The tranſient fits of mirth, produced from fermented liquors, and diſtilled ſpirits, are attended with proportionable depreſſions of ſpirit in their intervals. But the calm chearfulneſs ariſing from this water of health (as it may be juſtly called) is permanent. In which it emulates the virtues of that famous plant Gen Seng, ſo much valued in China as the only cordial that raiſes the ſpirits without depreſſing them. Tar water is ſo far from hurting the nerves as common cordials do, that it is highly uſeful in cramps, ſpaſms of the viſcera, and paralytic numbneſs.

67. Emetics are on certain occaſions adminiſtred with great ſucceſs. But the overſtraining and weakening of nature may be very juſtly apprehended from a courſe of emetics. They are nevertheleſs preſcribed and ſubſtituted for exerciſe. But it is well remarked in Plato's Timeus that vomits and purges are the worſt exerciſe in the world. There is ſomething in the mild operation of tar water, that ſeems more friendly to the œconomy, and forwards the digeſtions and ſecretions in a way more natural and benign, the mildneſs of this medicine being ſuch that I have known children take it, for above ſix months together, with great benefit, and without any inconvenience; and after long and repeated experience I do eſteem it a moſt excellent diet-drink fitted to all ſeaſons and ages.

68. It is I think allowed that the origin of the gout lies in a faulty digeſtion. And it is remarked by the ableſt phyſicians, that the gout is ſo difficult to cure, becauſe heating medicines aggravate its immediate, and cooling its remote cauſe. But tar water, although it contains active

principles that ſtrengthen the digeſtion beyond any thing I know, and conſequently muſt be highly uſeful, either to prevent or leſſen the following fit, or by invigorating the blood to caſt it upon the extremities, yet it is not of ſo heating a nature as to do harm even in the fit. Nothing is more difficult or diſagreeable than to argue men out of their prejudices, I ſhall not therefore enter into controverſies on this ſubject, but if men diſpute and object, ſhall leave the deciſion to time and trial.

69. In the modern practice, ſoap, opium, and mercury bid faireſt for univerſal medicines. The firſt of theſe is highly ſpoken of. But then thoſe who magnify it moſt, except againſt the uſe of it in ſuch caſes where the obſtruction is attended with a putrefactive alkali, or where an inflammatory diſpoſition appears. It is acknowledged to be very dangerous in a pthiſis, fever, and ſome other caſes in which tar water is not only ſafe but uſeful.

70. Opium though a medicine of great extent and efficacy, yet is frequently known to produce grievous diſorders in hyſterical or hypochondriacal perſons, who make a great part, perhaps the greateſt, of thoſe who lead ſedentary lives in theſe iſlands. Beſides, upon all conſtitutions dangerous errors may be committed in the uſe of opium.

71. Mercury hath of late years become a medicine of very general uſe. The extreme minuteneſs, mobility, and momentum of its parts, rendering it a moſt powerful cleanſer of all obſtructions, even in the moſt minute capillaries. But then we ſhould be cautious in the uſe of it, if we conſider, that the very thing which gives it power of doing good above other deobſtruents, doth alſo diſpoſe it to do miſchief. I mean its great momentum, the weight of it being about ten times that of blood, and the momentum being the joint product of the weight and velocity, it muſt needs operate with great force; and may it not be juſtly feared, that

that ſo great a force entering the minuteſt veſſels, and breaking the obſtructed matter, might alſo break or wound the fine tender coats of thoſe ſmall veſſels, and ſo bring on the untimely effects of old age, producing more, perhaps, and worſe obſtructions than thoſe it removed? Similar conſequences may juſtly be apprehended from other mineral and ponderous medicines. Therefore upon the whole, there will not perhaps be found any medicine more general in its uſe, or more ſalutary in its effects than tar water.

72. To ſuppoſe that all diſtempers ariſing from very different, and it may be from contrary cauſes, can be cured by one and the ſame medicine muſt ſeem chimerical. But it may with truth be affirmed, that the virtue of tar water extends to a ſurprizing variety of caſes very diſtant and unlike *. This I have experienced in my neighbours, my family, and myſelf. And as I live in a remote corner among poor neighbours, who for want of a regular phyſician have often recourſe to me, I have had frequent opportunities of trial, which convince me it is of ſo juſt a temperament as to be an enemy to all extremes. I have known it do great good in a cold watery conſtitution, as a cardiac and ſtomachic: and at the ſame time allay heat and feveriſh thirſt in another. I have known it correct coſtive habits in ſome, and the contrary habit in others. Nor will this ſeem incredible if it be conſidered that middle qualities naturally reduce the extreme. Warm water, for inſtance, mixed with hot and cold will leſſen the heat in that, and the cold in this.

73. They who know the great virtues of common ſoap, whoſe coarſe lixivial ſalts are the product of culinary fire, will not think it incredible, that virtues of mighty force and extent ſhould be found in a fine acid ſoap *, the ſalts and oil whereof, are a moſt elaborate product of nature and the ſolar light.

* Sect. 3, 4, 5, 6, 21, &c. † Sect. 58.

74. It

74. It is certain tar water warms, and therefore ſome may perhaps ſtill think it cannot cool. The more effectually to remove this prejudice, let it be farther conſidered, that as on the one hand, oppoſite cauſes do ſometimes produce the ſame effect, for inſtance, heat by rarefaction and cold by condenſation do both increaſe the air's elaſticity: ſo on the other hand, the ſame cauſe ſhall ſometimes produce oppoſite effects: heat for inſtance thins, and again heat coagulates the blood. It is not therefore ſtrange, that tar water ſhould warm one habit and cool another, have one good effect on a cold conſtitution, and another good effect on an inflamed one; nor, if this be ſo, that it ſhould cure oppoſite diſorders. All which juſtifies to reaſon, what I have often found true in fact. The ſalts, the ſpirits, the heat of tar water are of a temperature congenial to the conſtitution of a man which receives from it a kindly warmth, but no inflaming heat. It was remarkable that two children in my neighbourhood, being in a courſe of tar water, upon an intermiſſion of it, never failed to have their iſſues inflamed by an humour much more hot and ſharp than at other times. But its great uſe in the ſmall pox, pleuriſies, and fevers, is a ſufficient proof that tar water is not of an inflaming nature.

75. I have dwelt the longer on this head, becauſe ſome gentlemen of the faculty have thought fit to declare that tar water muſt inflame, and that they would never viſit any patient in a fever, who had been a drinker of it. But I will venture to affirm, that it is ſo far from increaſing a feveriſh inflammation, that it is on the contrary a moſt ready means to allay and extinguiſh it. It is of admirable uſe in fevers, being at the ſame time the ſureſt ſafeſt and moſt effectual both paregoric and cordial; for the truth of which, I appeal to any perſon's experience, who ſhall take a large draught of it milk warm in the paroxyſm of a fever, even when plain water or herb teas ſhall be found to have little or no effect. To me it ſeems that its ſingular and ſurprizing uſe in fevers of all

all kinds, were there nothing elſe, would be alone ſufficient to recommend it to the public.

76. The beſt phyſicians make the idea of a fever to conſiſt in a too great velocity of the heart's motion, and too great reſiſtance at the capillaries. Tar water, as it ſoftens and gently ſtimulates thoſe nice veſſels, helps to propel their contents, and ſo contributes to remove the latter part of the diſorder. And for the former, the irritating acrimony which accelerates the motion of the heart is diluted by watery, corrected by acid, and ſoftened by balſamic remedies, all which intentions are anſwered by this aqueous acid balſamic medicine. Beſides, the viſcid juices coagulated by the febrile heat are reſolved by tar water as a ſoap, and not too far reſolved, as it is a gentle acid ſoap; to which we may add, that the peccant humours and ſalts are carried off by its diaphoretic and diuretic qualities.

77. I found all this confirmed by my own experience in the late ſickly ſeaſon of the year one thouſand ſeven hundred and forty one, having had twenty-five fevers in my own family cured by this medicinal water, drunk copiouſly. The ſame method was practiſed on ſeveral of my poor neighbours with equal ſucceſs. It ſuddenly calmed the feveriſh anxieties, and ſeemed every glaſs to refreſh, and infuſe life and ſpirit into the patient. At firſt ſome of thoſe patients had been vomited, but afterwards I found that without vomiting, bleeding, bliſtering, or any other evacuation or medicine whatever, very bad fevers could be cured by the ſole drinking of tar water milk warm, and in good quantity, perhaps a large glaſs every hour or oftener taken in bed. And it was remarkable, that ſuch as were cured by this comfortable cordial, recovered health and ſpirits at once, while thoſe who had been cured by evacuations often languiſhed long, even after the fever had left them, before they could recover of their medicines and regain their ſtrength.

78. In

78. In peripneumonies and pleuriſies I have obſerved tar water to be excellent, having known ſome pleuritic perſons cured without bleeding, by a bliſter early applied to the ſtitch, and the copious drinking of tar water, four or five quarts, or even more in four and twenty hours. And I do recommend it to farther trial, whether in all caſes of a pleuriſy, one moderate bleeding, a bliſter on the ſpot and plenty of tepid tar water may not ſuffice, without thoſe repeated and immoderate bleedings, the bad effects of which are perhaps never got over. I do even ſuſpect that a pleuritic patient betaking himſelf to bed betimes, and drinking very copiouſly of tar water, may be cured by that alone without bleeding, bliſtering, or any other medicine whatſoever, certainly I have found this ſucceed at a glaſs every half hour.

79. I have known a bloody flux of long continuance, after divers medicines had been tried in vain, cured by tar water. But that which I take to be the moſt ſpeedy and effectual remedy in a bloody flux, is a clyſter of an ounce of common brown reſin diſſolved over a fire in two ounces of oil, and added to a pint of broth, which not long ſince I had frequent occaſion of trying when that diſtemper was epidemical. Nor can I ſay that any to whom I adviſed it miſcarried. This experiment I was led to make by the opinion I had of tar as a balſamic: and reſin is only tar inſpiſſated.

80. Nothing that I know corroborates the ſtomach ſo much as tar water *. Whence it follows, that it muſt be of ſingular uſe to perſons afflicted with the gout. And from what I have obſerved in five or ſix inſtances, I do verily believe it the beſt and ſafeſt medicine either to prevent the gout, or ſo to ſtrengthen nature againſt the fit, as to drive it from the vitals. Dr. Sydenham in his treatiſe of the gout, declares, that whoever finds a medicine the moſt efficacious for ſtrengthening digeſtion,

* Sect. 68.

will

will do more ſervice in the cure of that and other chronical diſtempers, than he can even form a notion of. And I leave it to trial, whether tar water be not that medicine, as I myſelf am perſuaded it is, by all the experiments I could make. But in all trials I would recommend diſcretion; for inſtance, a man with the gout in his ſtomach ought not to drink cold tar water. This eſſay leaves room for future experiment in every part of it, not pretending to be a complete treatiſe.

81. It is evident to ſenſe, that blood, urine, and other animal juices, being let to ſtand, ſoon contract a great acrimony. Juices, therefore from a bad digeſtion, retained and ſtagnating in the body, grow ſharp and putrid. Hence a fermenting heat, the immediate cauſe of the gout. The curing this by cooling medicines, as they would increaſe the antecedent cauſe, muſt be a vain attempt. On the other hand, ſpices and ſpirituous liquors, while they contribute to remove the antecedent cauſe, or bad digeſtion, would by inflaming the blood increaſe the proximate or immediate cauſe of the gout, to wit, the fermenting heat. The ſcope therefore muſt be, to find a medicine that ſhall corroborate, but not inflame. Bitter herbs are recommended; but they are weak in compariſon of tar water.

82. The great force of tar water, to correct the acrimony of the blood, appears in nothing more than in the cure of a gangrene, from an internal cauſe; which was performed on a ſervant of my own, by preſcribing the copious and conſtant uſe of tar water for a few weeks. From my repreſenting tar water as good for ſo many things, ſome perhaps may conclude it is good for nothing. But charity obligeth me to ſay, what I know, and what I think, howſoever it may be taken. Men may cenſure and object as they pleaſe, but I appeal to time and experiment. Effects miſimputed, caſes wrong told, circumſtances overlooked, perhaps too, prejudices and partialities againſt truth, may for a time prevail and

keep her at the bottom of her well, from whence nevertheleſs ſhe emergeth ſooner or later, and ſtrikes the eyes of all who do not keep them ſhut.

83. Boerhaave thinks a ſpecific may be found, for that peculiar venom, which infects the blood in the ſmall pox, and that the proſpect of ſo great a public benefit ſhould ſtir up men to ſearch for it. Its wonderful ſucceſs in preventing and mitigating that diſtemper *, would incline one to ſuſpect that tar water is ſuch a ſpecific, eſpecially ſince I have found it of ſovereign uſe as well during the ſmall pox as before it. Some think an eryſipelas and the plague differ only in degree. If ſo, tar water ſhould be uſeful in the plague, for I have known it cure an eryſipelas.

84. Tar water, as cleanſing, healing, and balſamic, is good in all diſorders of the urinary paſſages, whether obſtructed or ulcerated. Dr. Liſter ſuppoſeth, indeed, that turpentines act by a cauſtic quality, which irritates the coats of the urinary ducts to expel ſand or gravel. But it ſhould ſeem this expelling diuretic virtue, conſiſted rather in the ſalts than the reſin, and conſequently reſides in the tar water, gently ſtimulating by its ſalts, without the dangerous force of a cauſtic. The violent operation of ipecacuanha lies in its reſin, but the ſaline extract is a gentle purge and diuretic, by the ſtimulus of its ſalts.

85. That which acts as a mild cordial †, neither hurting the capillary veſſels as a cauſtic, nor affecting the nerves, nor coagulating the juices, muſt in all caſes be a friend to nature, and aſſiſt the *vis vitæ* in its ſtruggle againſt all kinds of contagion. And from what I have obſerved, tar water appears to me an uſeful preſervative in all epidemical diſorders, and againſt all other infection whatſoever, as well as that of the ſmall-pox. What effects the *animi pathemata* have in human maladies, is

* Sect. 2, 3. † Sect. 66.

well

well known, and conſequently the general benefit of ſuch a cardiac may be reaſonably ſuppoſed.

86. As the body is ſaid to clothe the ſoul, ſo the nerves may be ſaid to conſtitute her inner garment. And as the ſoul animates the whole, what nearly touches the ſoul relates to all. Therefore the aſperity of tartarous ſalts, and the fiery acrimony of alcaline ſalts, irritating and wounding the nerves, produce naſcent paſſions and anxieties in the ſoul; which both aggravate diſtempers, and render men's lives reſtleſs and wretched, even when they are afflicted with no apparent diſtemper. This is the latent ſpring of much woe, ſpleen, and *tædium vitæ*. Small imperceptible irritations of the minuteſt fibres or filaments cauſed by the pungent ſalts of wines and ſauces, do ſo ſhake and diſturb the microcoſms of high livers, as often to raiſe tempeſts in courts and ſenates. Whereas the gentle vibrations that are raiſed in the nerves, by a fine ſubtile acid, ſheathed in a ſmooth volatile oil *, ſoftly ſtimulating and bracing the nervous veſſels and fibres, promotes a due circulation and ſecretion of the animal juices, and creates a calm ſatisfied ſenſe of health. And accordingly I have often known tar water procure ſleep and compoſe the ſpirits in cruel vigils, occaſioned either by ſickneſs or by too intenſe application of mind.

87. In diſeaſes ſometimes accidents happen from without by miſmanagement, ſometimes latent cauſes operate within, jointly with the ſpecific taint or peculiar cauſe of the malady. The cauſes of diſtempers are often complicated, and there may be ſomething in the idioſyncraſy of the patient that puzzles the phyſician. It may therefore be preſumed that no medicine is infallible, not even in any one diſorder. But as tar water poſſeſſeth the virtues of fortifying the ſtomach, as well as purifying and invigorating the blood, beyond any medicine that I know, it may

* Sect. 59, 61.

be preſumed of great and general efficacy in all thoſe numerous illneſſes, which take their riſe from foul or vapid blood, or from a bad digeſtion. The animal ſpirits are elaborated from the blood. Such therefore as the blood is, ſuch will be the animal ſpirt, more or leſs, weaker or ſtronger. This ſheweth the uſefulneſs of tar water in all hyſteric and hypochondriac caſes: which together with the maladies from indigeſtion compriſe almoſt the whole tribe of chronical diſeaſes.

88. The ſcurvy may be reckoned in theſe climates an univerſal malady, as people in general are ſubject to it, and as it mixes more or leſs in almoſt all diſeaſes. Whether this proceeds from want of elaſticity in our air, upon which the tone of the veſſels depends, and upon that the ſeveral ſecretions: or whether it proceeds from the moiſture of our climate, or the groſſneſs of our food, or the ſalts in our atmoſphere, or from all theſe together. Thus much at leaſt ſeems not abſurd to ſuppoſe, that as phyſicians in Spain and Italy are apt to ſuſpect the venereal taint to be a latent principle, and bear a part in every illneſs, ſo far as good reaſon the ſcurvy ſhould be conſidered by our phyſicians as having ſome ſhare in moſt diſorders and conſtitutions that fall in their way. It is certain our perſpiration is not ſo free as in clearer air and warmer climates. Perſpirable humours not diſcharged will ſtagnate and putrify. A diet of animal food will be apt to render the juices of our bodies alcaleſcent. Hence ichorous and corroſive humours and many diſorders. Moiſt air makes viſcid blood; and ſaline air inflames this viſcid blood. Hence broken capillaries, extravaſated blood, ſpots and ulcers, and other ſcorbutic ſymptoms. The body of a man attracts and imbibes the moiſture and ſalts of the air, and whatever floats in the atmoſphere, which as it is common to all, ſo it affects all more or leſs.

89. Doctor Muſgrave thinks the Devonſhire ſcurvy a relique of the leproſy, and that it is not owing to the qualities of the air. But as theſe

inſulars

inſulars in general live in a groſs ſaline air, and their veſſels being leſs elaſtic, are conſequently leſs able to ſubdue and caſt off what their bodies as ſponges draw in, one would be tempted to ſuſpect the air not a little concerned, eſpecially in ſuch a ſituation as that of Devonſhire. In all theſe Britiſh iſlands we enjoy a great mediocrity of climate, the effect whereof is, that we have neither heat enough to exalt and diſſipate the groſs vapours, as in Italy, nor cold enough to condenſe and precipitate them, as in Sweden. So they are left floating in the air, which we conſtantly breathe, and imbibe through the whole ſurface of our bodies. And this together with exhalations from coal fires, and the various foſſils wherein we abound, doth greatly contribute to render us ſcorbutic and hypochondriac.

90. There are ſome who derive all diſeaſes from the ſcurvy, which indeed muſt be allowed to create or mimic moſt other maladies. Boerhaave tells us, it produceth pleuritic, colic, nephritic, hepatic pains, various fevers, hot, malignant, intermitting dyſenteries, faintings, anxieties, dropſies, conſumptions, convulſions, palſies, fluxes of blood. In a word, it may be ſaid to contain the ſeeds and origin of almoſt all diſtempers. Inſomuch that a medicine which cures all ſorts of ſcurvy, may be preſumed good for moſt other maladies.

91. The ſcurvy, doth not only in variety of ſymptoms imitate moſt diſtempers, but alſo when come to a height, in degree of virulence equal the moſt malignant. Of this we have a remarkable proof, in that horrible deſcription of the ſcorbutic patients in the hoſpitals of Paris, given by monſieur Poupart, in the memoirs of the royal academy of ſciences, for the year one thouſand ſix hundred and ninety nine. That author thinks he ſaw ſome reſemblance in it to the plague of Athens. It is hard to imagine any thing more dreadful than the caſe of thoſe men, rotting alive by the ſcurvy in its ſupreme degree. To obviate ſuch putrefaction,

faction, I believe the moſt effectual method would be, to embalm (if one may ſo ſay) the living body with tar water copiouſly drunk; and this belief is not without experience.

92. It is the received opinion that the animal ſalts of a ſound body are of a neutral, bland, and benign nature: that is, the ſalts in the juices paſt the *primæ viæ*, are neither acid nor alcaline, having been ſubdued by the conſtitution, and changed into a third nature. Where the conſtitution wants force to do this, the aliment is not duly aſſimilated; and ſo far as the ſalts retain their priſtine qualities, ſickly ſymptoms enſue, acids and alkalies not perfectly ſubdued, producing weak ferments in the juices. Hence ſcurvy, cachexy, and a long train of ills.

93. A cachexy or ill habit is much of the ſame kind with the ſcurvy, proceeds from the ſame cauſes and is attended with like ſymptoms, which are ſo manifold and various, that the ſcurvy may well be looked on as a general cachexy, infecting the whole habit and vitiating all the digeſtions. Some have reckoned as many ſorts of the ſcurvy, as there are different taints of the blood. Others have ſuppoſed it a collection of all illneſſes together. Some ſuppoſe it an accumulation of ſeveral diſeaſes *in fieri*. Others take it for an aſſemblage of the reliques of old diſtempers.

94. But thus much is certain, the cure of the ſcurvy is no more to be attempted by ſtrongly active medicines than (to uſe the ſimilitude of an ingenious writer,) a thorn in the fleſh, or pitch on ſilk to be removed by force. The viſcid humour muſt be gently reſolved and diluted, the tone of the veſſels recovered by a moderate ſtimulation, and the tender fibres and capillary veſſels gradually cleared from the concreted ſtuff that adheres and obſtructs them. All which is in the apteſt manner performed by a watery diluent, containing a fine vegetable ſoap. And although a complete cure by alteratives, operating on the ſmall capillaries, and by inſenſible

inſenſible diſcharges, muſt require length of time, yet the good effect of this medicine on cachetic and ſcorbutic perſons, is ſoon perceived, by the change it produceth in their pale diſcoloured looks, giving a florid healthy countenance in leſs time than perhaps any other medicine.

95. It is ſuppoſed by phyſicians, that the immediate cauſe of the ſcurvy lies in the blood, the fibrous part of which is too thick and the ſerum too thin and ſharp: and that hence ariſeth the great difficulty in the cure, becauſe in the correcting of one part, regard muſt be had to the other. It is well known, how extremely difficult it is to cure an inveterate ſcurvy: how many ſcorbutic patients have grown worſe by an injudicious courſe of evacuations: how many are even rendered incurable by the treatment of inconſiderate phyſicians: and how difficult, tedious and uncertain the cure is in the hands even of the beſt, who are obliged to uſe ſuch variety and change of medicines, in the different ſtages of that malady: which nevertheleſs may be cured (if I may judge by what I have experienced) by the ſole, regular, conſtant, copious uſe of tar water.

96. Tar water moderately inſpiſſates with its balſamic virtue, and renders mild the thin and ſharp part of the blood. The ſame, as a ſoapy medicine, diſſolves the grumous concretions of the fibrous part. As a balſam it deſtroys the ulcerous acrimony of the humours, and as a deobſtruent it opens and cleans the veſſels, reſtores their tone, and ſtrengthens the digeſtion, whoſe defects are the principal cauſe of ſcurvy and cachexy.

97. In the cure of the ſcurvy, the principal aim is to ſubdue the acrimony of the blood and juices. But as this acrimony proceeds from different cauſes, or even oppoſite, as acid and alkaline, what is good in one ſort of ſcurvy proves dangerous, or even mortal, in another. It is well known,

known, that hot antiſcorbutics, where the juices of the body are alcaleſcent, increaſe the diſeaſe. And ſour fruits and vegetables produce a like effect in the ſcurvy, cauſed by an acid acrimony. Hence fatal blunders are committed by unwary practitioners, who, not diſtinguiſhing the nature of the diſeaſe, do frequently aggravate, inſtead of curing it. If I may truſt what trials I have been able to make, this water is good in the ſeveral kinds of ſcurvy, acid, alkaline, and muriatic, and I believe it the only medicine that cures them all without doing hurt to any. As it contains a volatile acid * with a fine volatile oil, why may not a medicine cool in one part and warm in another be a remedy to either extreme †. I have obſerved it to produce a kindly genial warmth without heat, a thing to be aimed at in all ſorts of ſcurvy. Beſides, the balſam in tar water ſheaths all ſcorbutic ſalts alike: and its great virtues as a digeſter and deobſtruent are of general uſe in all ſcorbutic, and I may add, in all chronical caſes whatſoever.

98. I cannot be ſure that I have tried it in a ſcrofulous caſe, though I have tried it ſucceſsfully in one that I ſuſpected to be ſo. And I apprehend it would be very ſerviceable in ſuch diſorders. For although Dr. Gibbs in his treatiſe on the king's evil derives that diſeaſe from a coagulating acid, which is alſo agreeable to the opinion of ſome other phyſicians, and although tar water contain an acid, yet, as it is a ſoap ‡, it reſolves inſtead of coagulating the juices of the body.

99. For hyſterical and hypochondriacal diſorders ſo frequent among us, it is commonly ſuppoſed that all acids are bad. But I will venture to except the acid ſoap of tar water, having found by my own experience and that of many others, that it raiſes the ſpirits, and is an excellent antihyſteric, nor leſs innocent than potent, which cannot be ſaid of thoſe

* Sect. 7. † Sect. 72. ‡ Sect. 58.

others

others in common uſe, that often leave people worſe than they found them.

100. In a high degree of ſcurvy a mercurial ſalivation is looked on by many as the only cure. Which by the vehement ſhock it gives the whole frame, and the ſenſible ſecretion it produceth may be thought more adequate to ſuch an effect. But the diſorder occaſioned by that violent proceſs, it is to be feared, may never be got over. The immediate danger, the frequent bad effects, the extreme trouble and nice care attending ſuch a courſe do very deſervedly make people afraid of it. And though the ſenſible ſecretion therein be ſo great, yet in a longer tract of time the uſe of tar water may produce as great a diſcharge of ſcorbutic ſalts by urine and by perſpiration, the effect of which laſt, though not ſo ſenſible, may yet be greater than that of ſalivation; eſpecially if it be true, that in common life inſenſible perſpiration is to nutrition, and all ſenſible excretions as five to three.

101. Many hyſteric and ſcorbutic ailments, many taints contracted by themſelves, or inherited from their anceſtors, afflict the people of condition in theſe iſlands, often rendering them, upon the whole, much more unhappy than thoſe whom poverty and labour have ranked in the loweſt lot of life; which ailments might be ſafely removed or relieved by the ſole uſe of tar water: and thoſe lives which ſeem hardly worth living for bad appetite, low ſpirits, reſtleſs nights, waſting pains and anxieties, be rendered eaſy and comfortable.

102. As the nerves are inſtruments of ſenſation, it follows that ſpaſms in the nerves may produce all ſymptoms, and therefore a diſorder in the nervous ſyſtem ſhall imitate all diſtempers, and occaſion, in appearance, an aſthma for inſtance, a pleuriſy, or a fit of the ſtone. Now whatever is good for the nerves in general, is good againſt all ſuch ſymptoms. But

tar water, as it includes in an eminent degree the virtues of warm gums and reſins, is of great uſe for comforting and ſtrengthening the nerves*, curing twitches in the nervous fibres, cramps alſo, and numbneſs in the limbs, removing anxieties and promoting ſleep, in all which caſes I have known it very ſucceſsful.

103. This ſafe and cheap medicine ſuits all circumſtances and all conſtitutions, operating eaſily, curing without diſturbing, raiſing the ſpirits without depreſſing them, a circumſtance that deſerves repeated attention, eſpecially in theſe climates, where ſtrong liquors ſo fatally and ſo frequently produce thoſe very diſtreſſes they are deſigned to remedy; and, if I am not miſinformed, even among the ladies themſelves, who are truly much to be pitied. Their condition of life makes them a prey to imaginary woes, which never fail to grow up in minds unexerciſed and unemployed. To get rid of theſe, it is ſaid, there are, who betake themſelves to diſtilled ſpirits. And it is not improbable, they are led gradually to the uſe of thoſe poiſons by a certain complaiſant pharmacy, too much uſed in the modern practice, palſy drops, poppy cordial, plague-water, and ſuch like, which being in truth nothing but drams diſguiſed, yet coming from the apothecaries, are conſidered only as medicines.

104. The ſoul of man was ſuppoſed by many ancient ſages, to be thruſt into the human body as into a priſon, for puniſhment of paſt offences. But the worſt priſon is the body of an indolent epicure, whoſe blood is inflamed by fermented liquors† and high ſauces, or rendered putrid, ſharp, and corroſive, by a ſtagnation of the animal juices through ſloth and indolence; whoſe membranes are irritated by pungent ſalts; whoſe mind is agitated by painful oſcillations of the nervous‡ ſyſtem, and whoſe nerves are mutually affected by the irregular paſſions of his

* Sect. 86. † Sect. 66. ‡ Sect. 86.

mind.

mind. This ferment in the animal œconomy darkens and confounds the intellect. It produceth vain terrors and vain conceits, and ſtimulates the ſoul with mad deſires, which, not being natural, nothing in nature can ſatisfy. No wonder, therefore, there are ſo many fine perſons of both ſexes, ſhining themſelves, and ſhone on by fortune, who are inwardly miſerable and ſick of life.

105. The hardneſs of ſtubbed vulgar conſtitutions, renders them inſenſible of a thouſand things, that fret and gall thoſe delicate people, who, as if their ſkin was peeled off, feel to the quick every thing that touches them. The remedy for this exquiſite and painful ſenſibility is commonly ſought from fermented, perhaps from diſtilled liquors, which render many lives wretched, that would otherwiſe have been only ridiculous. The tender nerves, and low ſpirits of ſuch poor creatures, would be much relieved by the uſe of tar water, which might prolong and cheer their lives. I do therefore recommend to them the uſe of a cordial, not only ſafe and innocent, but giving health and ſpirit as ſurely as other cordials deſtroy them.

106. I do verily think, there is not any other medicine whatſoever, ſo effectual to reſtore a crazy conſtitution, and cheer a dreary mind, or ſo likely to ſubvert that gloomy empire of the ſpleen * which tyranniſeth over the better ſort (as they are called) of theſe free nations; and maketh them, in ſpite of their liberty and property, more wretched ſlaves than even the ſubjects of abſolute power, who breathe clear air in a ſunny climate. While men of low degree often enjoy a tranquillity and content, that no advantage of birth or fortune can equal. Such, indeed, was the caſe, while the rich alone could afford to be debauched; but when even beggars became debauchees, the caſe was altered.

* Sect. 103.

107. The public virtue and ſpirit of the Britiſh legiſlature, never ſhewed itſelf more conſpicuous in any act, than in that for ſuppreſſing the immoderate uſe of diſtilled ſpirits among the people, whoſe ſtrength and numbers conſtitute the true wealth of a nation: though evaſive arts will, it is feared, prevail ſo long as diſtilled ſpirits of any kind are allowed, the character of Engliſhmen in general, being that of Brutus, *Quicquid vult valde vult.* But why ſhould ſuch a canker be tolerated in the vitals of a ſtate, under any pretence or in any ſhape whatſoever? Better by far, the whole preſent ſet of diſtillers were penſioners of the public, and their trade aboliſhed by law; ſince all the benefit thereof put together would not balance the hundredth part of its miſchief.

108. To prove the deſtructive effects of ſuch ſpirits with regard both to the human ſpecies and individuals, we need not go ſo far as our colonies, or the ſavage natives of America. Plain proof may be had nearer home. For, albeit there is in every town or diſtrict throughout England, ſome tough dram-drinker, ſet up as the devil's decoy, to draw in proſelytes; yet the ruined health and morals, and the beggary of ſuch numbers evidently ſhew that we need no other enemy to complete our deſtruction, than this cheap luxury at the lower end of the ſtate, and that a nation lighted up at both ends muſt ſoon be conſumed.

109. It is much to be lamented that our inſulars, who act and think ſo much for themſelves, ſhould yet from groſſneſs of air and diet, grow ſtupid or doat ſooner than other people, who by virtue of elaſtic air, water-drinking, and light food preſerve their faculties to extreme old age; an advantage which may perhaps be approached, if not equalled, even in theſe regions, by tar water; temperance, and early hours; the laſt is a ſure addition to life, not only in regard of time, which, being taken from ſleep, the image of death, is added to the waking hours, but alſo in regard of longevity and duration in the vulgar ſenſe. I may

ſay

ſay too, in regard of ſpirit and vivacity, which, within the ſame compaſs of duration, may, truly and properly be affirmed to add to man's life: it being manifeſt, that one man, by a briſker motion of his ſpirits and ſucceſſion of his ideas, ſhall live more in one hour, than another in two: and that the quantity of life is to be eſtimated, not merely from the duration, but alſo from the intenſeneſs of living. Which intenſe living, or, if I may ſo ſay, lively life, is not more promoted by early hours as a regimen, than by tar water as a cordial; which acts, not only as a ſlow medicine, but hath alſo an immediate and chearful * effect on the ſpirits.

110. It muſt be owned, the light attracted, ſecreted and detained in tar *, and afterwards drawn off in its fineſt balſamic particles, by the gentle menſtruum of cold water, is not a violent and ſudden medicine, always to produce its effect at once, (ſuch by irritating, often do more miſchief than good) but a ſafe and mild alterative, which penetrates the whole ſyſtem, opens, heals, and ſtrengthens the remote veſſels, alters and propels their contents, and enters the minuteſt capillaries, and cannot therefore, otherwiſe, than by degrees and in time work a radical cure of chronic diſtempers. It gives nevertheleſs ſpeedy relief in moſt caſes, as I have found by myſelf and many others. I have been ſurpriſed to ſee perſons fallen away and languiſhing under a bad digeſtion, after a few weeks recover a good ſtomach, and with it fleſh and ſtrength, ſo as to ſeem renewed, by the drinking of tar water. The ſtrength and quantity of this water to be taken by each individual perſon is beſt determined from experience. And as for the time of taking, I never knew any evil enſue from its being continued ever ſo long; but, on the contrary, many and great advantages, which ſometimes would not perhaps begin to ſhew themſelves till it had been taken two or three months.

* Sect. 66. † Sect. 8, 29, 40.

111. We

111. We learn from Pliny, that in the firſt ferment of new wine or muſtum, the ancients were wont to ſprinkle it with powdered reſin, which gave it a certain ſprightlineſs, *quædam ſaporis acumina.* This was eſteemed a great improver of its odour and taſte, and was I doubt not, of its ſalubrity alſo. The brown old reſin, that is to ſay, hardened tar, as being more eaſily pulverized and ſifted, was moſt in requeſt for this purpoſe. They uſed likewiſe to ſeaſon their wine veſſels with pitch or reſin. And I make no doubt, that if our vintners would contrive to medicate their wines with the ſame ingredients, they might improve and preſerve them, with leſs trouble and expence to themſelves, and leſs danger to others. He that would know more particulars of this matter may conſult Pliny and Columella. I ſhall only add, that I doubt not a ſimilar improvement may be made of malt liquor.

112. The ῥητίνη of Theophraſtus and reſina of Pliny are ſometimes uſed in a general ſenſe, to ſignify all ſorts of oily viſcid exſudations from plants or trees. The crude watery juice, that riſeth early in the ſpring, is gradually ripened and inſpiſſated by the ſolar heat, becoming in orderly ſucceſſion with the ſeaſons an oil, a balſam, and at laſt a reſin. And it is obſerved by chymiſts, that turpentine diſſolved over a gentle fire, is, by the conſtant operation of heat, ſucceſſively transformed into oil, balſam, pitch, and hard friable reſin, which will incorporate with oil or rectified ſpirit, but not with water.

113. Sir John Floyer remarks, that we want a method for the uſe of turpentine, and again, he who ſhall hit, ſaith he, on the pleaſanteſt method of giving turpentine, will do great cures in the gout, ſtone, catarrhs, dropſies and cold ſcurvies, rheumatiſms, ulcers, and obſtructions of the glands. Laſtly, he ſubjoins, that for the uſe of altering and amending the juices and fibres, it muſt be given frequently, and in ſuch ſmall quantities at a time, and in ſo commodious a manner, as will agree beſt

beſt with the ſtomach *, ſtay longeſt in the body, and not purge itſelf off; for large doſes (ſaith he) go through too quick, and beſides offend the head. Now the infuſion of tar or turpentine in cold water ſeems to ſupply the very method that was wanted, as it leaves the more unctuous, and groſs parts behind †, which might offend the ſtomach, inteſtines and head; and as it may be eaſily taken, and as often, and in ſuch quantity and ſuch degree of ſtrength, as ſuits the caſe of the patient, nor ſhould it ſeem, that the fine ſpirit and volatile oil, obtained by infuſion of tar ‡, is inferior to that of turpentine, to which it ſuperadds the virtue of wood ſoot, which is known to be very great with reſpect to the head and nerves; and this appears evident from the manner of obtaining tar ‖. And as the fine volatile parts of tar or turpentine are drawn off by infuſion in cold water, and eaſily conveyed throughout the whole ſyſtem of the human body; ſo it ſhould ſeem the ſame method may be uſed with all ſorts of balſams or reſins whatſoever, as the readieſt, eaſieſt, and moſt inoffenſive, as well as in many caſes the moſt effectual way of obtaining and imparting their virtues.

114. After having ſaid ſo much of the uſes of tar, I muſt farther add, that being rubbed on them, it is an excellent preſervative of the teeth and gums: that it ſweetens the breath, and that it clears and ſtrengthens the voice. And, as its effects are various and uſeful, ſo there is nothing to be feared from the operation of an alternative ſo mild and friendly to nature. It was a wiſe maxim of certain ancient philoſophers, that diſeaſes ought not to be irritated by medicines §. But no medicine diſturbs the animal œconomy leſs than this, which, if I may truſt my own experience, never produces any diſorder in a patient when rightly taken.

* Sect. 9. † Sect. 47. ‡ Sect. 7, 42, 58. ‖ Sect. 13. § Sect. 103.

115. I knew indeed a perſon who took a large glaſs of tar water juſt before breakfaſt, which gave him an invincible nauſea and diſguſt, although he had before received the greateſt benefit from it. But if the tar water be taken and made in the manner preſcribed at the beginning of this eſſay, it will, if I miſtake not, have enough of the ſalt to be uſeful, and little enough of the oil to be inoffenſive. I mean my own manner of making it, and not the American which makes it ſometimes too ſtrong and ſometimes too weak, and however ſerviceable as there uſed merely for a preſervative againſt the ſmall-pox, yet may not be fit to uſe in all thoſe various caſes wherein I have found tar water ſo ſucceſsful. Perſons more delicate than ordinary may render it palatable, by mixing a drop of the chymical oil of nutmegs, or a ſpoonful of mountain wine in each glaſs. It may not be amiſs to obſerve, that I have known ſome, whoſe nice ſtomachs could not bear it in the morning, take it at night going to bed without any inconvenience. For outward waſhes and fomentations, it may be made ſtronger as by pouring on warm water; alſo for brute beaſts, as horſes, in whoſe diſorders I have found it very uſeful, I believe more ſo than that bituminous ſubſtance called Barbadoes tar.

116. In very dangerous and acute caſes much may be taken and often; as far as the ſtomach can bear. But in chronical caſes, about half a pint night and morning, may ſuffice, or, in caſe ſo large a doſe ſhould prove diſagreeable, half the quantity may be taken four times, to wit, in the morning early, at night going to bed, and about two hours after dinner and breakfaſt. A medicine of ſo great virtue in ſo many different diſorders, and eſpecially in that grand enemy, the fever, muſt needs be a benefit to mankind in general. There are nevertheleſs three ſorts of people to whom I would peculiarly recommend it: ſea-faring perſons, ladies, and men of ſtudious and ſedentary lives.

117. To

117. To ſailors and all ſea-faring perſons, who are ſubject to ſcorbutic diſorders and putrid fevers, eſpecially in long ſouthern voyages, I am perſuaded this tar water would be very beneficial. And this may deſerve particular notice in the preſent courſe of marine expeditions, when ſo many of our countrymen have periſhed by ſuch diſtempers, contracted at ſea and in foreign climates. Which, it is probable, might have been prevented by the copious uſe of tar water.

118. This ſame water will alſo give charitable relief to the ladies *, who often want it more than the pariſh poor; being many of them never able to make a good meal, and ſitting pale, puny, and forbidden like ghoſts, at their own table, victims of vapours and indigeſtion.

119. Studious perſons alſo pent up in narrow holes, breathing bad air, and ſtooping over their books, are much to be pitied. As they are debarred the free uſe of air and exerciſe, this I will venture to recommend as the beſt ſuccedaneum to both. Though it were to be wiſhed, that modern ſcholars would, like the ancients, meditate and converſe more in walks and gardens and open air, which upon the whole, would perhaps be no hindrance to their learning, and a great advantage to their health. My own ſedentary courſe of life had long ſince thrown me into an ill habit, attended with many ailments, particularly a nervous colic, which rendered my life a burden, and the more ſo, becauſe my pains were exaſperated by exerciſe. But ſince the uſe of tar water, I find, though not a perfect recovery from my old and rooted illneſs, yet ſuch a gradual return of health and eaſe, that I eſteem my having taken this medicine the greateſt of all temporal bleſſings, and am convinced, that under providence, I owe my life to it.

* Sect. 103.

120. In the diſtilling of turpentine and other balſams by a gentle heat, it hath been obſerved, that there riſeth firſt an acid ſpirit * that will mix with water; which ſpirit, except the fire be very gentle, is loſt. This grateful acid ſpirit that firſt comes over, is, as a learned chymiſt and phyſician informs us, highly refrigeratory, diuretic, ſudorific, balſamic or preſervative from putrefaction, excellent in nephritic caſes, and for quenching thirſt, all which virtues are contained in the cold infuſion, which draws forth from tar only its fine flower or quinteſſence, if I may ſo ſay, or the native vegetable ſpirit, together with a little volatile oil.

121. The diſtinguiſhing principle of all vegetables, that whereon their peculiar ſmell, taſte, and ſpecific properties depend, ſeems to be ſome extremely fine and ſubtile ſpirit, whoſe immediate vehicle is an exceeding thin volatile oil, which is itſelf detained in a groſſer and more viſcid reſin or balſam, lodged in proper cells in the bark and ſeeds, and moſt abounding in autumn or winter, after the crude juices have been thoroughly concocted, ripened, and impregnated with ſolar light. The ſpirit itſelf is by ſome ſuppoſed to be an oil highly ſubtilized, ſo as to mix with water. But ſuch volatile oil is not the ſpirit, but only its vehicle. Since aromatic oils being long expoſed to air, will loſe their ſpecific ſmell and taſte, which fly off with the ſpirit or vegetable ſalt, without any ſenſible diminution of the oil.

122. Thoſe volatile ſalts, that are ſet free and raiſed by a gentle heat, may juſtly be ſuppoſed eſſential †, and to have pre-exiſted in the vegetable; whereas the lixivial fixed ſalts obtained by the incineration of the ſubject, whoſe natural conſtituent parts have been altered or deſtroyed by the extreme force of fire, are by later chymiſts upon very good grounds, ſuppoſed not to have pre-exiſted therein; all ſuch ſalts appearing, from the experiments of ſignior Redi, not to preſerve the virtues of

* Sect. 7. † Sect. 8.

the

the reſpective vegetable ſubjects; and to be alike purgative and in an equal degree, whatſoever may be the ſhape of their points, whether ſharp or obtuſe. But although fixed or lixivial ſalts may not contain the original properties of the ſubject; yet volatile ſalts raiſed by a ſlight heat from vegetables are allowed to preſerve their native virtues: and ſuch ſalts are readily imbibed by water.

123. The moſt volatile of the ſalts, and the moſt attenuated part of the oil, may be ſuppoſed the firſt and readieſt to impregnate a cold infuſion *. And this will aſſiſt us to account for the virtues of tar water. That volatile acid in vegetables, which reſiſts putrefaction and is their great preſervative, is detained in a ſubtile oil miſcible with water, which oil is itſelf impriſoned in the reſin or groſſer part of the tar, from which it is eaſily ſet free and obtained pure by cold water.

124. The mild native acids are obſerved more kindly to work upon, and more thoroughly to diſſolve, metallic bodies, than the ſtrongeſt acid ſpirits produced by a vehement fire; and it may be ſuſpected, they have the ſame advantage as a medicine. And as no acid, by the obſervation of ſome of the beſt chymiſts, can be obtained from the ſubſtance of animals thoroughly aſſimilated, it ſhould follow, that the acids received into a healthy body muſt be quite ſubdued and changed by the vital powers: but it is eaſier to ſubdue and aſſimilate † the gentler than the ſtronger acids.

125. I am very ſenſible, that on ſuch ſubjects arguments fall ſhort of evidence: and that mine fall ſhort even of what they might have been if I enjoyed better health, or thoſe opportunities of a learned commerce, from which I am cut off in this remote corner. I ſhall nevertheleſs go on as I have begun, and proceed by reaſon, by conjecture, and by au-

* Sect. 1, 7. † Sect. 48.

thority, to caſt the beſt light I can on the obſcure paths that lie in my way.

126. Sir Iſaac Newton, Boerhaave, and Homberg are all agreed, that the acid is a fine ſubtile ſubſtance, pervading the whole terraqueous globe; which produceth divers kinds of bodies, as it is united to different ſubjects. This according to Homberg is the pure ſalt, ſalt the principle, in itſelf ſimilar and uniform, but never found alone. And although this principle be called the ſalt of the earth, yet it ſhould ſeem it may more properly be called the ſalt of the air, ſince earth turned up and lying fallow receives it from the air. And it ſhould ſeem that this is the great principle of vegetation, derived into the earth from all ſorts of manures, as well as from the air. The acid is allowed to be the cauſe of fermentation in all fermented liquors. Why therefore, may it not be ſuppoſed to ferment the earth, and to conſtitute that fine penetrating principle, which introduces and aſſimilates the food of plants, and is ſo fugitive as to eſcape all the filtrations and perquiſitions of the moſt nice obſervers?

127. It is the doctrine of Sir Iſaac Newton and Monſieur Homberg, that, as the watery acid is that which renders ſalt ſoluble in water, ſo it is that ſame which joined to the earthy part makes it a ſalt. Let it therefore be conſidered, that the organs * of plants are tubes, the filling, unfolding, and diſtending whereof by liquors, doth conſtitute what is called the vegetation or growth of the plant. But earth itſelf is not ſoluble in water, ſo as to form one vegetable fluid therewith. Therefore the particles of earth muſt be joined with a watery acid, that is, they muſt become ſalts in order to diſſolve in water; that ſo, in the form of a vegetable juice, they may paſs through the ſtrainers and tubes of the root into the body of the plant, ſwelling and diſtending its parts and or-

* Sect. 30, 31, 35.

gans,

gans, that is, increaſing its bulk. Therefore the vegetable matter of the earth is in effect earth changed into ſalt. And to render earth fertile, is to cauſe many of its particles to aſſume a ſaline form.

128. Hence it is obſerved, there are more ſalts in the root than in the bark, more ſalts in vegetables during the ſpring than in the autumn or winter, the crude ſaline juices being in the ſummer months partly evaporated, and partly ripened by the action and mixture of light. Hence alſo it appears, why the dividing of earth, ſo as to enlarge its ſurface, whereby it may admit more acid from the air, is of ſuch uſe in promoting vegetation. And why aſhes, lime, and burnt clay are found ſo profitable manures, fire being in reality the acid, as is proved in the ſequel *. Marls alſo and ſhells are uſeful, foraſmuch as thoſe alcaline bodies attract the acid, and raiſe an effervescence with it, thereby promoting a fermentation in the glebe. The excrements of animals and putrid vegetables do in like manner contribute to vegetation, by increaſing the ſalts of the earth. And where fallows are well broken, and lie long to receive the acid of the air into all their parts: this alone will be ſufficient to change many terrene particles into ſalts, and conſequently render them ſoluble in water, and therefore a fit aliment for vegetables.

129. The acid, ſaith Homberg, is always joined to ſome ſulphur, which determines it to this or that ſpecies, producing different ſalts, as it is the vegetable, bituminous, or metallique ſulphur. Even the alkaline, whether volatile or lixivial ſalts, are ſuppoſed to be nothing but this ſame acid ſtrictly detained by oil and earth, in ſpite of the extreme force of fire, which lodgeth in them, without being able to diſlodge ſome remains of the acid.

* Sect. 202.

130. Salts,

130. Salts, according to Sir Iſaac Newton, are dry earth and watery acid united by attraction, the acid rendering them ſoluble in water *. He ſuppoſeth the watery acid to flow round the terreſtrial part, as the ocean doth round the earth, being attracted thereby, and compares each particle of ſalt, to a chaos whereof the innermoſt part is hard and earthy, but the ſurface ſoft and watery. Whatever attracts and is attracted moſt ſtrongly, is an acid in his ſenſe.

131. It ſeems impoſſible to determine the figures of particular ſalts. All acid ſolvents together with the diſſolved bodies are apt to ſhoot into certain figures. And the figures, in which the foſſil ſalts cryſtallize, have been ſuppoſed the proper natural ſhapes of them and their acids. But Homberg hath clearly ſhewed the contrary: foraſmuch as the ſame acid diſſolving different bodies, aſſumes different ſhapes. Spirit of nitre, for inſtance, having diſſolved copper ſhoots into hexagonal cryſtals; the ſame having diſſolved iron, ſhoots into irregular ſquares; and again, having diſſolved ſilver, forms thin cryſtals of a triangular figure.

132. Homberg, nevertheleſs, holds in general, that acids are ſhaped like daggers, and alkalies like ſheaths: and that moving in the ſame liquor, the daggers run into the ſheaths fitted to receive them, with ſuch violence as to raiſe that effervеſcence obſerved in the mixture of acids and alkalies. But it ſeems very difficult to conceive, how, or why the mere configuration of daggers and ſheaths, floating in the ſame liquor, ſhould cauſe the former to ruſh with ſuch vehemence, and direct their points ſo aptly into the latter, any more than a parcel of ſpigots and foſſets floating together in the ſame water, ſhould ruſh one into the other.

* Sect. 127.

133. It

133. It ſhould ſeem rather, that the vehement attraction which Sir Iſaac Newton attributes to all acids, whereby he ſuppoſeth them to ruſh towards, penetrate, ſhake and divide the moſt ſolid bodies, and to ferment the liquid of vegetables, could better account for this phænomenon. It is in this attraction, that Sir Iſaac placeth all their activity, and indeed it ſhould ſeem, the figures of ſalts were not of ſuch efficacy in producing their effects, as the ſtrong active powers whereby they are agitated and do agitate other bodies. Eſpecially if it be true (what was before remarked) that lixivious ſalts are alike purgative, whatever may be the ſhape of their angles, whether more or leſs acute or obtuſe.

134. Sir Iſaac Newton accounts for the watery acid's making earthy corpuſcles ſoluble in water, by ſuppoſing the acid to be a mean between earth and water, its particles greater than thoſe of water, and leſs than thoſe of earth, and ſtrongly to attract both. But perhaps there is no neceſſary reaſon, for ſuppoſing the parts of the acid groſſer than the parts of water, in order to produce this effect; may not this as well be accounted for, by giving them only a ſtrong attraction or coheſion with the bodies to which they are joined?

135. The acid ſpirit or ſalt, that mighty inſtrument in the hand of nature, reſiding in the air, and diffuſed throughout that whole element, is diſcernible alſo in many parts of the earth, particularly in foſſils, ſuch as ſulphur, vitriol, and allum; it was already obſerved from Homberg, that this acid is never found pure, but hath always ſulphur joined with it, and is claſſed by the difference of its ſulphurs, whether mineral vegetable, or animal.

136. Salts are vulgarly reckoned the moſt active of chymical principles. But Homberg derives all their activity from the ſulphurs joined with them. From which alſo, as hath been ſaid, he derives all their kinds and differences.

differences *. Salt, water, oil, and earth ſeem to be originally the ſame in all vegetables. All the difference, according to the chymiſts, ariſeth from a ſpirit reſiding in the oil, called the rector or archæus. This is otherwiſe called by chymiſts, *ens primum*, or the native ſpirit, whereon depend, and wherein are contained, the peculiar flavour and odour, the ſpecific qualities and virtues of the plant.

137. Theſe native ſpirits or vegetable ſouls are all breathed or exhaled into the air, which ſeems the receptacle as well as ſource of all ſublunary forms, the great maſs or chaos which imparts and receives them. The air or atmoſphere that ſurrounds our earth contains a mixture of all the active volatile parts of the whole habitable world, that is of all vegetables, minerals and animals. Whatever perſpires, corrupts, or exhales impregnates the air; which, being acted upon by the ſolar fire, produceth within itſelf all ſorts of chymical operations, diſpenſing again thoſe ſalts and ſpirits in new generations, which it had received from putrefactions.

138. The perpetual oſcillations of this elaſtic and reſtleſs element operate without ceaſing, on all things that have life, whether animal or vegetable, keeping their fibres, veſſels, and fluids in a motion always changing; as heat, cold, moiſture, dryneſs, and other cauſes alter the elaſticity of the air. Which accounts, it muſt be owned, for many effects. But there are many more which muſt be derived from other principles or qualities in the air. Thus iron and copper are corroded and gather ruſt in the air, and bodies of all ſorts are diſſolved or corrupted, which ſheweth an acid to abound and diffuſe itſelf throughout the air.

139. By this ſame air fire is kindled, the lamp of life preſerved, reſpiration, digeſtion, nutrition, the pulſe of the heart and motion of all the muſcles ſeem to be performed. Air therefore is a general agent, not

* Sect. 129.

only

only exerting its own, but calling forth the qualities or powers of all other bodies, by a diviſion, comminution, and agitation of their particles, cauſing them to fly off and become volatile and active.

140. Nothing ferments, vegetates, or putrifies without air, which operates with all the virtues of the bodies included in it; that is, of all nature; there being no drug, ſalutary or poiſonous, whoſe virtues are not breathed into the air. The air therefore is an active maſs of numberleſs different principles, the general ſource of corruption and generation; on one hand dividing, abrading, and carrying off the particles of bodies, that is, corrupting or diſſolving them; on the other, producing new ones into being; deſtroying and beſtowing forms without intermiſſion.

141. The ſeeds of things ſeem to lie latent in the air, ready to appear and produce their kind, whenever they light on a proper matrix. The extremely ſmall ſeeds of fern, moſſes, muſhrooms, and ſome other plants are concealed and wafted about in the air, every part whereof ſeems replete with ſeeds of one kind or other. The whole atmoſphere ſeems alive. There is every where acid to corrode, and ſeed to engender. Iron will ruſt, and mold will grow in all places. Virgin earth becomes fertile, crops of new plants ever and anon ſhew themſelves, all which demonſtrates the air to be a common ſeminary and receptacle of all vivifying principles.

142. Air may alſo be ſaid to be the ſeminary of minerals and metals, as it is of vegetables. Mr. Boyle informs us, that the exhauſted ores of tin and iron being expoſed to the air become again impregnated with metal, and that ore of alum having loſt its ſalt recovers it after the ſame manner. And numberleſs inſtances there are of ſalts produced by the air, that vaſt collection or treaſury of active principles, from which all ſublunary bodies ſeem to derive their forms, and on which animals depend for their life and breath.

143. That there is ſome latent vivifying ſpirit diſperſed throughout the air common experience ſheweth; inſomuch as it is neceſſary both to vegetables and animals * whether terreſtrial or aquatic, neither beaſts, inſects, birds nor fiſhes being able to ſubſiſt without air. Nor doth all air ſuffice, there being ſome quality or ingredient, of which when air is deprived, it becometh unfit to maintain either life or flame. And this even though the air ſhould retain its elaſticity; which, by the by, is an argument that air doth not act only as an antagoniſt to the intercoſtal muſcles. It hath both that and many other uſes. It gives and preſerves a proper tone to the veſſels: this elaſtic fluid promotes all ſecretions: its oſcillations keep every part in motion: it pervades and actuates the whole animal ſyſtem, producing great variety of effects, and even oppoſite in different parts, cooling at the ſame time and heating, diſtending and contracting, coagulating and reſolving, giving and taking, ſuſtaining life and impairing it, preſſing without and expanding within, abrading ſome parts, at the ſame time inſinuating and ſupplying others, producing various vibrations in the fibres, and ferments in the fluids; all which muſt needs enſue from ſuch a ſubtile, active, heterogeneous and elaſtic fluid.

144. But there is, as we before obſerved, ſome one quality or ingredient in the air, on which life more immediately and principally depends. What that is, though men are not agreed, yet it is agreed it muſt be the ſame thing that ſupports the vital and the common flame; it being found that when air, by often breathing in it, is become unfit for the one, it will no longer ſerve for the other. The like is obſervable in poiſonous damps or ſteams, wherein flame cannot be kindled. As is evident in the grotto del cane near Naples. And here it occurs, to recommend the plunging them in cold water, as an experiment to be tried on perſons affected by breathing a poiſonous vapour in old vaults, mines, deep holes or cavities under ground. Which, I am apt to think, might ſave the

* Sect. 138, 139.

lives

lives of ſeveral, by what I have ſeen practiſed on a dog convulſed and in all appearance dead, but inſtantly reviving on being taken out of the above-mentioned grotto and thrown into a lake adjacent.

145. Air the general menſtruum and ſeminary, ſeemeth to be only an aggregate of the volatile parts of all natural beings, which variouſly combined and agitated produceth many various effects. Small particles in a near and cloſe ſituation ſtrongly act upon each other, attracting, repelling, vibrating. Hence divers fermentations, and all the variety of meteors, tempeſts, and concuſſions both of earth and firmament. Nor is the microcoſm leſs affected thereby. Being pent up in the viſcera, veſſels, and membranes of the body, by its ſalts, ſulphurs, and elaſtic power, it engenders colics, ſpaſms, hyſteric diſorders and other maladies.

146. The ſpecific quality of air is taken to be permanent elaſticity. Mr. Boyle is expreſly of this opinion. And yet, whether there be any ſuch thing as permanently elaſtic air may be doubted, there being many things which ſeem to rob the air of this quality, or at leaſt leſſen and ſuſpend its exertion. The ſalts and ſulphurs, for inſtance, that float in the air abate much of its elaſticity by their attraction.

147. Upon the whole it is manifeſt, that air is no diſtinct element, but a maſs or mixture of things the moſt heterogeneous and even oppoſite to each other * which become air, by acquiring an elaſticity and volatility from the attraction of ſome active, ſubtile ſubſtance; whether it be called fire, æther, light, or the vital ſpirit of the world; in like manner as the particles of antimony, of themſelves not volatile, are carried off in ſublimation and rendered volatile, by cohering with the particles of ſal ammoniac. But action and reaction being equal, the ſpring of this æthereal ſpirit is diminiſhed by being imparted. Its velocity and ſubtilty are alſo

* Sect. 137, 145.

leſs, from its being mixed with groſſer particles. Hence ſound moves ſlower than light, as mud than water.

148. Whether air be only freed and fixed, or generated and deſtroyed, it is certain that air begins and ceaſes to exert or ſhew itſelf. Much by experiments ſeems to be generated, not only from animals, fruits, and vegetables, but alſo from hard bodies. And it is obſerved by Sir Iſaac Newton, that air produced from hard bodies is moſt elaſtic. The tranſmutation of elements, each into other, hath been anciently held. In Plutarch we find it was the opinion of Heraclitus, that the death of fire was a birth to air, and the death of air a birth to water. This opinion is alſo maintained by Sir Iſaac Newton. Though it may be queſtioned, whether what is thought a change be not only a diſguiſe.

149. Fire ſeems the moſt elaſtic and expanſive of all bodies. It communicates this quality to moiſt vapours and dry exhalations, when it heats and agitates their parts, cohering cloſely with them, overcoming their former mutual attraction, and cauſing them, inſtead thereof, reciprocally to repel each other and fly aſunder, with a force proportionable to that wherewith they had cohered.

150. Therefore in air we may conceive two parts, the one more groſs which was raiſed and carried off from the bodies of this terraqueous maſs: the other a fine ſubtile ſpirit by means whereof, the former is rendered volatile and elaſtic. Together they compoſe a medium, whoſe elaſticity is leſs than that of pure æther, fire, or ſpirit, in proportion to the quantity of ſalts, vapours, and heterogeneous particles contained therein. Hence, it follows, that there is no ſuch thing as pure ſimple element of air. It follows alſo that on the higheſt mountains, air ſhould be more rare than in proportion to the vulgar rule, of the ſpaces be-

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ing reciprocally as the preſſures: and ſo in fact it is ſaid to have been found, by the gentlemen of the French academy of ſciences.

151. Æther, fire, or ſpirit being attracted and clogged by heterogeneous particles becometh leſs active; and the particles cohering with thoſe of æther, become more active than before. Air therefore is a maſs of various particles, abraded and ſublimated from wet and dry bodies of all ſorts, cohering with particles of æther; the whole permeated by pure æther, or light, or fire: for theſe words are uſed promiſcuouſly by ancient philoſophers,

152. This æther or pure inviſible fire, the moſt ſubtile and elaſtic of all bodies, ſeems to pervade and expand itſelf throughout the whole univerſe. If air be the immediate agent or inſtrument in natural things, it is the pure inviſible fire that is the firſt natural mover or ſpring, from whence the air derives its power *. This mighty agent is every where at hand, ready to break forth into action, if not reſtrained and governed with the greateſt wiſdom. Being always reſtleſs and in motion, it actuates and enlivens the whole viſible maſs, is equally fitted to produce and to deſtroy, diſtinguiſhes the various ſtages of nature, and keeps up the perpetual round of generations and corruptions, pregnant with forms which it conſtantly ſends forth and reſorbs. So quick in its motions, ſo ſubtile and penetrating in its nature, ſo extenſive in its effects, it ſeemeth no other than the vegetative ſoul or vital ſpirit of the world.

153. The animal ſpirit in man is the inſtrumental or phyſical cauſe both of ſenſe and motion. To ſuppoſe ſenſe in the world, would be groſs and unwarranted. But locomotive faculties are evident in all its parts. The Pythogoreans, Platoniſts, and Stoics held the world to be an animal. Though ſome of them have choſen to conſider it as a vegetable.

* Sect. 139, 149, 151.

However

However the phenomena and effects do plainly ſhew there is a ſpirit that moves, and a mind or providence that preſides. This providence, Plutarch ſaith, was thought to be in regard to the world, what the ſoul is in regard to man.

154. The order and courſe of things, and the experiments we daily make, ſhew there is a mind that governs and actuates this mundane ſyſtem, as the proper real agent and cauſe. And that the inferior inſtrumental cauſe is pure æther, fire, or the ſubſtance of light * which is applied and determined by an infinite mind in the macrocoſm or univerſe, with unlimited power, and according to ſtated rules; as it is in the microcoſm with limited power and ſkill by the human mind. We have no proof, either from experiment or reaſon, of any other agent or efficient cauſe than mind or ſpirit. When therefore we ſpeak of corporeal agents or corporeal cauſes, this is to be underſtood in a different, ſubordinate, and improper ſenſe.

155. The principles whereof a thing is compounded, the inſtrument uſed in its production, and the end for which it was intended, are all in vulgar uſe termed cauſes, though none of them be ſtrictly ſpeaking agent or efficient. There is not any proof that an extended corporeal or mechanical cauſe doth really and properly act, even motion itſelf being in truth a paſſion. Therefore though we ſpeak of this fiery ſubſtance as acting, yet it is to be underſtood only as a mean or inſtrument, which indeed is the caſe of all mechanical cauſes whatſoever. They are nevertheleſs ſometimes termed agents and cauſes, although they are by no means active in a ſtrict and proper ſignification. When, therefore, force, power, virtue, or action are mentioned as ſubſiſting in an extended and corporeal or mechanical being, this is not to be taken in a true genuine and real, but only in a groſs and popular ſenſe, which ſticks in appear-

* Sect. 29, 37, 136, 149.

ances,

ances, and doth not analyze things to their firſt principles. In compliance with eſtabliſhed language and the uſe of the world, we muſt employ the popular current phraſe. But then in regard to truth we ought to diſtinguiſh its meaning. It may ſuffice to have made this declaration once for all, in order to avoid miſtakes.

156. The *calidum innatum*, the vital flame, or animal ſpirit in man is ſuppoſed the cauſe of all motions, in the ſeveral parts of his body, whether voluntary or natural. That it is accounted the inſtrument, by means whereof the mind exerts and manifeſts herſelf in the motions of the body. In the ſame ſenſe may not fire be ſaid to have force, to operate, and agitate the whole ſyſtem of the world, which is held together and informed by one preſiding mind, and animated throughout by one and the ſame fiery ſubſtance, as an inſtrumental and mechanical agent, not as a primary real efficient.

157. This pure ſpirit or inviſible fire is ever ready to exert and ſhew itſelf in its effects *, cheriſhing, heating, fermenting, diſſolving, ſhining and operating in various manners, where a ſubject offers to employ or determine its force. It is preſent in all parts of the earth and firmament, though perhaps latent and unobſerved, till ſome accident produceth it into act, and renders it viſible in its effects.

158. There is no effect in nature, great, marvellous, or terrible but proceeds from fire, that diffuſed and active principle, which at the ſame time that it ſhakes the earth and heavens, will enter, divide, and diſſolve the ſmalleſt, cloſeſt, and moſt compacted bodies. In remote cavities of the earth it remains quiet, till perhaps an accidental ſpark from the colliſion of one ſtone againſt another kindles an exhalation, that gives birth to an earthquake or tempeſt, which ſplits mountains or overturns cities.

* Sect. 152.

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This ſame fire ſtands unſeen in the focus of a burning glaſs, till ſubjects for it to act upon come in its way, when it is found to melt, calcine, or vitrify the hardeſt bodies.

159. No eye could ever hitherto diſcern, and no ſenſe perceive, the animal ſpirit in a human body, otherwiſe than from its effects. The ſame may be ſaid of pure fire, or the ſpirit of the univerſe, which is perceived only by means of ſome other bodies, on which it operates or with which it is joined. What the chymiſts ſay, of pure acids being never found alone, might as well be ſaid of pure fire.

160. The mind of man acts by an inſtrument neceſſarily. The το ἡγεμονικὸν, or mind preſiding in the world, acts by an inſtrument freely. Without inſtrumental and ſecond cauſes, there could be no regular courſe of nature. And without a regular courſe, nature could never be underſtood. Mankind muſt always be at a loſs, not knowing what to expect, or how to govern themſelves, or direct their actions for the obtaining of any end. Therefore in the government of the world phyſical agents, improperly ſo called, or mechanical, or ſecond cauſes, or natural cauſes, or inſtruments, are neceſſary to aſſiſt, not the governor, but the governed.

161. In the human body the mind orders and moves the limbs: but the animal ſpirit is ſuppoſed the immediate phyſical cauſe of their motion. So likewiſe in the mundane ſyſtem, a mind preſides, but the immediate, mechanical, or inſtrumental cauſe, that moves or animates all its parts, is the pure elementary fire or ſpirit of the world. The more fine and ſubtile part or ſpirit is ſuppoſed to receive the impreſſions of the firſt mover, and communicate them to the groſſer ſenſible parts of this world. Motion, though in metaphyſical rigour and truth a paſſion or mere effect, yet, in phyſics paſſeth for an action. And by this action all effects are ſuppoſed

ſuppoſed to be produced. Hence the various communications, determinations, accelerations of motion conſtitute the laws of nature.

162. The pure æther or inviſible fire contains parts of different kinds, that are impreſſed with different forces, or ſubjected to different laws of motion, attraction, repulſion and expanſion, and endued with divers diſtinct habitudes towards other bodies. Theſe ſeem to conſtitute the many various qualities *, virtues, flavours, odours, and colours, which diſtinguiſh natural productions. The different modes of coheſion, attraction, repulſion and motion, appear to be the ſource from whence the ſpecific properties are derived, rather than different ſhapes or figures. This as hath been already obſerved, ſeems confirmed by the experiment of fixed ſalts operating one way, notwithſtanding the difference of their angles. The original particles productive of odours, flavours, and other properties, as well as of colours, are, one may ſuſpect, all contained and blended together in that univerſal and original ſeminary of pure elementary fire; from which they are diverſly ſeparated and attracted, by the various ſubjects of the animal, vegetable, and mineral kingdoms; which thereby become claſſed into kinds, and endued with thoſe diſtinct properties, which continue till their ſeveral forms, or ſpecific proportions of fire return into the common maſs.

163. As the ſoul acts immediately on pure fire, ſo pure fire operates immediately on air: that is, the abraſions of all terreſtrial things being rendered volatile and elaſtic by fire †, and at the ſame time leſſening the volatility and expanſive force of the fire, whoſe particles they attract and adhere to ‡, there is produced a new fluid, more volatile than water or earth, and more fixed than fire. Therefore the virtues and operations imputed to air, muſt be ultimately attributed to fire, as that which imparts activity to air itſelf.

* Sect. 37, 40, 4. † Sect. 149, 150, 152. ‡ Sect. 147.

164. The element of ætherial fire or light ſeems to comprehend, in a mixed ſtate, the ſeeds, the natural cauſes and forms * of all ſublunary things. The groſſer bodies ſeparate, attract, and repel the ſeveral conſtituent particles of that heterogeneous element; which being parted from the common maſs, make diſtinct eſſences, producing and combining together ſuch qualities and properties, as are peculiar to the ſeveral ſubjects, and thence often extracted in eſſential oils or odoriferous waters, from whence they exhale into the open air, and return into their original element.

165. Blue, red, yellow, and other colours, have been diſcovered by Sir Iſaac Newton to depend on the parted rays or particles of light. And in like manner, a particular odour or flavour, ſeemeth to depend on peculiar particles of light or fire †; as appears from heats being neceſſary to all vegetation whatſoever, and from the extreme minuteneſs and volatility of thoſe vegetable ſouls or forms, flying off from the ſubjects without any ſenſible diminution of their weight. Theſe particles blended in one common ocean, ſhould ſeem to conceal the diſtinct forms, but, parted and attracted by proper ſubjects, diſcloſe or produce them. As the particles of light which when ſeparated, form diſtinct colours, being blended are loſt in one uniform appearance.

166. Agreeably thereto, an ætherial ſubſtance or fire was ſuppoſed by Heraclitus to be the ſeed of the generation of all things, or that from which all things drew their original. The Stoics alſo taught, that all ſubſtance was originally fire, and ſhould return to fire: that an active ſubtile fire was diffuſed or expanded throughout the whole univerſe; the ſeveral parts whereof were produced, ſuſtained, and held together by its force. And it was the opinion of the Pythagoreans, as Laertius informs us, that heat or fire was the principle of life animating the whole ſyſ-

* Sect. 43. † Sect. 40.

tem,

tem, and penetrating all the elements *. The Platoniſts too, as well as the Pythagoreans, held fire to be the immediate natural agent, or animal ſpirit; to cheriſh, to warm, to heat, to enlighten, to vegetate, to produce the digeſtions, circulations, ſecretions, and organical motions in all living bodies, vegetable or animal, being effects of that element, which, as it actuates the macrocoſm, ſo it animates the microcoſm. In the Timæus of Plato, there is ſuppoſed ſomething like a net of fire, and rays of fire in a human body. Doth not this ſeem to mean the animal ſpirit, flowing, or rather darting through the nerves?

167. According to the Peripatetics, the form of heaven, or the fiery æthereal ſubſtance, contains the forms of all inferior beings *. It may be ſaid to teem with forms, and impart them to ſubjects fitted to receive them. The vital force thereof in the Peripatetic ſenſe is vital to all, but diverſly received according to the diverſity of the ſubjects. So all colours are virtually contained in the light; but their actual diſtinctions of blue, red, yellow, and the reſt, depend on the difference of the objects which it illuſtrates. Ariſtotle in the book *de mundo*, ſuppoſeth a certain fifth eſſence, an ætherial nature unchangeable and impaſſive; and next in order a ſubtile, flaming ſubſtance, lighted up, or ſet on fire by that ætherial and divine nature. He ſuppoſeth, indeed, that God is in heaven, but that his power, or a force derived from him, doth actuate and pervade the univerſe.

168. If we may credit Plutarch, Empedocles thought æther or heat to be Jupiter. Æther by the ancient philoſophers was uſed to ſignify promiſcuouſly ſometimes fire and ſometimes air. For they diſtinguiſh two ſorts of air. Plato in the Timæus ſpeaking of air ſaith there are two kinds, the one more fine and ſubtile, called æther, the other more groſs and replete with vapours! This æther or purer medium ſeems to have been

* Sect. 152, 153. † Sect. 43.

the air or principle, from which all things according to Anaximenes derived their birth, and into which they were back again reſolved at their death. Hippocrates in his treatiſe *de diæta*, ſpeaketh of a fire pure and inviſible; and this fire, according to him, is that which ſtirring and giving movement to all things cauſes them to appear, or, as he ſtyles it come into evidence, that is to exiſt, every one in its time and according to its deſtiny.

169. This pure fire, æther, or ſubſtance of light, was accounted in itſelf inviſible and imperceptible to all our ſenſes, being perceived only by its effects, ſuch as heat, flame, and rarefaction. To which we may add, that the moderns pretend farther to have perceived it by weight, inaſmuch as the aromatic oils which moſt abound with fire, as being the moſt readily and vehemently inflamed, are above all others the heavieſt. And by an experiment of Mr. Homberg's, four ounces of regulus of antimony, being calcined by a burning glaſs for an hour together, were found to have imbibed and fixed ſeven drachms of the ſubſtance of light.

170. Such is the rarefying and expanſive force of this element, as to produce in an inſtant of time the greateſt and moſt ſtupendous effects: a ſufficient proof not only of the power of fire, but alſo of the wiſdom with which it is managed, and withheld from burſting forth every moment to the utter ravage and deſtruction of all things. And it is very remarkable, that this ſame element, ſo fierce and deſtructive, ſhould yet be ſo variouſly tempered and applied, as to be withal the ſalutary warmth, the genial, cheriſhing and vital flame of all living creatures. It is not therefore to be wondered that Ariſtotle thought, the heat of a living body to be ſomewhat divine and celeſtial, derived from that pure æther to which he ſuppoſed the incorporeal deity (χωρισὸν εἶδος) to be immediately united, or on which he ſuppoſed it immediately to act.

171. The

171. The Platoniſts held that intellect reſided in ſoul, and ſoul in an ætherial vehicle. And that as the ſoul was a middle nature reconciling intellect with æther, ſo æther was another middle nature, which reconciled and connected the ſoul with groſſer bodies *. Galen likewiſe taught that, admitting the ſoul to be incorporeal, it hath for its immediate tegument or vehicle a body of æther or fire, by the intervention whereof it moveth other bodies and is mutually affected by them. This interior clothing was ſuppoſed to remain upon the ſoul, not only after death, but after the moſt perfect purgation, which in length of time according to the followers of Plato and Pythagoras cleanſed the ſoul,

——————— *purumqus reliquit*
Æthereum ſenſum atque auräi ſimplicis ignem.

This tunicle of the ſoul, whether it be called pure æther, or luciform vehicle, or animal ſpirit ſeemeth to be that which moves and acts upon the groſs organs, as it is determined by the ſoul from which it immediately receives impreſſion, and in which the moving force truly and properly reſides. Some moderns have thought fit to deride all that is ſaid of ætherial vehicles, as mere jargon or words without a meaning. But they ſhould have conſidered, that all ſpeech concerning the ſoul is altogether, or for the moſt part, metaphorical; and that agreeably thereunto, Plato ſpeaketh of the mind or ſoul, as a driver that guides and governs a chariot, which is, not unfitly, ſtyled αὐγοειδὲς a luciform æthereal vehicle or ὄχημα, terms expreſſive of the purity, lightneſs, ſubtilty and mobility of that fine celeſtial nature, in which the ſoul immediately reſides and operates.

172. It was a tenet of the Stoics that the world was an animal, and that providence anſwered to the reaſonable ſoul in man. But then the providence or mind was ſuppoſed by them, to be immediately reſident

* Sect. 152, 154.

or preſent in fire, to dwell therein, and to act thereby. Briefly, they conceived God to be an intellectual and fiery ſpirit, πνεῦμα νοερὸν καὶ πυρῶδες. Therefore though they looked on fire * as the τὸ ἡγεμονικὸν or governing principle of the world; yet it was not ſimply fire but animated with a mind.

173. Such are the bright and lively ſignatures of a divine mind, operating and diſplaying itſelf in fire and light throughout the world, that as Ariſtotle obſerves in his book *de mundo*, all things ſeem full of divinities, whoſe apparitions on all ſides ſtrike and dazzle our eyes. And it muſt be owned the chief philoſophers and wiſe men of antiquity, how much ſoever they attributed to ſecond cauſes and the force of fire, yet they ſuppoſed a mind or intellect always reſident therein, active or provident, reſtraining its force and directing its operations.

174. Thus Hippocrates in his treatiſe, *de diæta*, ſpeaks of a ſtrong but inviſible fire †, that rules all things without noiſe. Herein, ſaith he, reſides ſoul, underſtanding, prudence, growth, motion, diminution, change, ſleep and waking. This is what governs all things, and is never in repoſe. And the ſame author, in his tract, *de carnibus*, after a ſerious preface ſetting forth that he is about to declare his own opinion, expreſſeth it in theſe terms. That which we call heat θερμὸν appears to me ſomething immortal, which underſtands all things, which ſees and knows both what is preſent and what is to come.

175. This ſame heat is alſo what Hippocrates calls nature, the author of life and death, good and evil. It is farther to be noted of this heat, that he maketh it the object of no ſenſe. It is that occult, univerſal nature, and inward inviſible force, which actuates and animates the whole world, and was worſhipped by the ancients under the name of Saturn;

* Sect. 166. † Sect. 168.

which

which Voſſius judges not improbably to be derived from the Hebrew word Satar, to lie hidden or concealed. And what hath been delivered by Hippocrates, agrees with the notions of other philoſophers: Heraclitus *, for inſtance, who held fire to be the principle and cauſe of the generation of all things, did not mean thereby an inanimate element, but, as he termed it, πυρ ἀείζωον, an everlaſting fire.

176. Theophraſtus, in his book, *de igne*, diſtinguiſheth between heat and fire. The firſt he conſiders as a principle or cauſe, not that which appeareth to ſenſe as a paſſion or accident exiſting in a ſubject, and which is in truth the effect of that unſeen principle. And it is remarkable, that he refers the treating of this inviſible fire or heat, to the inveſtigation of the firſt cauſes. Fire, the principle, is neither generated nor deſtroyed, is every where and always preſent †: while its effects in different times and places ſhew themſelves more or leſs, and are very various, ſoft and cheriſhing, or violent and deſtructive, terrible or agreeable, conveying good and evil, growth and decay, life and death, throughout the mundane ſyſtem.

177. It is allowed by all, that the Greeks derived much of their philoſophy from the Eaſtern nations. And Heraclitus is thought by ſome to have drawn his principles from Orpheus, as Orpheus did from the Ægyptians; or, as others write, he had been auditor of Hippaſus, a Pythagorean, who held the ſame notion of fire, and might have derived it from Ægypt by his maſter Pythagoras, who had travelled into Ægypt, and been inſtructed by the ſages of that nation. One of whoſe tenets it was, that fire was the principle of all action; which is agreeable to the doctrine of the Stoics, that the whole of things is adminiſtered by a fiery intellectual ſpirit. In the Aſclepian Dialogue, we find this notion, that all

* Sect. 166. † Sect. 157.

parts

parts of the world vegetate by a fine ſubtile æther, which acts as an engine or inſtrument, ſubject to the will of the ſupreme God.

178. As the Platoniſts held intellect to be lodged in ſoul, and ſoul in æther *; ſo it paſſeth for a doctrine of Triſmegiſtus in the Pimander, that mind is clothed by ſoul, and ſoul by ſpirit. Therefore as the animal ſpirit of man, being ſubtile and luminous, is the immediate tegument of the human ſoul, or that wherein and whereby ſhe acts; even ſo the ſpirit of the world, that active fiery æthereal ſubſtance of light, that permeates and animates the whole ſyſtem, is ſuppoſed to clothe the ſoul, which clothes the mind of the univerſe.

179. The Magi likewiſe ſaid of God, that he had light for his body and truth for his ſoul. And in the Chaldaic oracles, all things are ſuppoſed to be governed by a πῦρ νοερὸν or intellectual fire. And in the ſame oracles, the creative mind is ſaid to be clothed with fire: ἐσταμένος πυρὶ πῦρ which oriental reduplication of the word fire ſeems to imply the extreme purity and force thereof. Thus alſo in the Pſalms, Thou art clothed with light as with a garment. Where, the word rendered light might have been rendered fire, the Hebrew letters being the ſame with thoſe in the word which ſignifies fire, all the difference being in the pointing, which is juſtly counted a late invention. That other ſcripture ſentence is remarkable: who maketh his miniſters a flaming fire: which might, perhaps, be rendered more agreeably to the context, as well as conſiſtently with the Hebrew, after this manner: who maketh flaming fire his miniſters: and the whole might run thus: who maketh the winds his meſſengers, and flaming fire his miniſters.

180. A notion of ſomething divine in fire, animating the whole world, and ordering its ſeveral parts, was a tenet of very general extent † be-

* Sect. 171. † Sect. 156, 157, 163, 166, 167, 168, 170, 172, 173, 174, 175, 177, &c.

ing

ing embraced in the moſt diſtant times and places, even among the Chineſe themſelves; who make tien, æther, or heaven, the ſovereign principle or cauſe of all things, and teach that the celeſtial virtue, by them called li, when joined to corporeal ſubſtance, doth faſhion, diſtinguiſh, and ſpecificate all natural beings. This li of the Chineſe ſeems to anſwer the forms of the Peripatetics. And both bear analogy to the foregoing philoſophy of fire.

181. The heaven is ſuppoſed pregnant with virtues and forms, which conſtitute and diſcriminate the various ſpecies of things. And we have more than once obſerved, that, as the light, fire, or celeſtial æther, being parted by refracting or reflecting bodies, produceth variety of colours; even ſo, that ſame apparently uniform ſubſtance being parted and ſecreted by the attracting and repelling powers of the divers ſecretory ducts of plants and animals, that is, by natural chymiſtry, produceth or imparteth the various ſpecific properties of natural bodies. Whence the taſtes and odours and medicinal virtues ſo various in vegetables.

182. The tien is conſidered and adored by the learned Chineſe, as living and intelligent æther, the πῦρ νοερὸν of the Chaldæans and the Stoics. And the worſhip of things celeſtial, the ſun and ſtars, among the eaſtern nation leſs remote, was on account of their fiery nature, their heat and light, and the influence thereof. Upon theſe accounts, the ſun was looked on by the Greek theologers as the ſpirit of the world, and the power of the world. The cleanſing quality, the light and heat of fire are natural ſymbols of purity, knowledge, and power, or if I may ſo ſay, the things themſelves ſo far as they are perceptible to our ſenſes, or in the ſame ſenſe as motion is ſaid to be action. Accordingly, we find a religious regard was paid to fire, both by Greeks and Romans, and indeed by moſt, if not all, the nations of the world.

183. The worſhip of Veſta at Rome was, in truth, the worſhip of fire.

Nec tu aliud Veſtam quam vivam intellige flammam,

Saith Ovid in his Faſti. And as in old Rome the eternal fire was religiouſly kept by virgins, ſo in Greece, particularly at Delphi and Athens, it was kept by widows. It is well known that Vulcan or fire was worſhipped with great diſtinction by the Ægyptians. The Zabii or Sabeans are alſo known to have been worſhippers of fire. It appears too from the Chaldean oracles, that fire was regarded as divine by the ſages of that nation. And it is ſuppoſed that ur of the Chaldæans was ſo called from the Hebrew word ſignifying fire, becauſe fire was publicly worſhipped in that city. That a religious worſhip was paid to fire by the ancient Perſians and their Magi, is atteſted by all antiquity. And the ſect of Perſées, or old Gentiles, of whom there are conſiderable remains at this day both in the Mogols country and in Perſia doth teſtify the ſame.

184. It doth not ſeem that their proſtrations before the perpetual fires, preſerved with great care in their Pyreia, or fire temples, were merely a civil reſpect, as Dr. Hyde would have it thought. Although he brings good proof that they do not invoke the fire on their altars, or pray to it, or call it God: and that they acknowledge a ſupreme inviſible deity. Civil reſpects are paid to things as related to civil power: but ſuch relation doth not appear in the preſent caſe. It ſhould ſeem therefore, that they worſhip God as preſent in the fire, which they worſhip or reverence, not ultimately or for itſelf, but relatively to the ſupreme being. Which it is not unlikely was elſewhere the caſe at firſt; though the practice of men, eſpecially of the vulgar, might in length of time degenerate from the original inſtitution, and reſt in the object of ſenſe.

185. Doctor Hyde, in his hiſtory of the religion of the ancient Perſians, would have it thought, that they borrowed the uſe and reverence of perpetual

petual fires, from the Jewiſh practice preſcribed in the Levitical law, of keeping a perpetual fire burning on the altar. Whether that was the caſe or not, thus much one may venture to ſay, it ſeems probable that whatever was the original of this cuſtom among the Perſians, the like cuſtoms among the Greeks and Romans were derived from the ſame ſource.

186. It muſt be owned there are many paſſages in holy ſcripture *, that would make one think, the ſupreme being was in a peculiar manner preſent and manifeſt in the element of fire. Not to inſiſt that God is more than once ſaid to be a conſuming fire, which might be underſtood in a metaphorical ſenſe, the divine apparitions were by fire, in the buſh, at mount Sinai, on the tabernacle, in the cloven tongues. God is repreſented in the inſpired writings, as deſcending in fire, as attended by fire, or with fire going before him. Celeſtial things as angels, chariots, and ſuch like phenomena are inveſted with fire, light, and ſplendor. Ezekiel in his viſions beheld fire and brightneſs, lamps, burning coals of fire, and flaſhes of lightening. In a viſion of Daniel, the throne of God appeared like a fiery flame, and his wheels like burning fire. Alſo a fiery flame iſſued and came forth from before him.

187. At the transfiguration, the apoſtles ſaw our Saviour's face ſhining as the ſun, and his raiment white as light, alſo a lucid cloud or body of light, out of which the voice came; which viſible light and ſplendor was, not many centuries ago, maintained by the Greek church, to have been divine, and uncreated, and the very glory of God; as may be ſeen in the hiſtory wrote by the emperor John Cantacuzene. And of late years biſhop Patrick gives it as his opinion, that in the beginning of the world, the Shecinah or divine preſence, which was then frequent and ordinary, appeared by light or fire. In commenting on that paſſage, where Cain is

* Sect. 179.

ſaid to have gone out from the preſence of the Lord, the biſhop obſerves that if Cain after this turned a downright idolater, as many think, it is very likely he introduced the worſhip of the ſun, as the beſt reſemblance he could find of the glory of the Lord, which was wont to appear in a flaming light. It would be endleſs to enumerate all the paſſages of holy ſcripture, which confirm and illuſtrate this notion, or repreſent the Deity as appearing and operating by fire. The miſconſtruction of which might poſſibly have miſled the Gnoſtics, Baſilidians, and other ancient heretics into an opinion, that Jeſus Chriſt was the viſible corporeal ſun.

188. We have ſeen, that in the moſt remote ages and countries, the vulgar as well as the learned, the inſtitutions of lawgivers, as well as the reaſonings of philoſophers, have ever conſidered the element of fire in a peculiar light, and treated it with more than common regard, as if it were ſomething of a very ſingular and extraordinary nature. Nor are there wanting authors of principal account among the moderns, who entertain like notions concerning fire, eſpecially among thoſe who are moſt converſant in that element, and ſhould ſeem beſt acquainted with it.

189. Mr. Homberg the famous modern chymiſt, who brought that art to ſo great perfection, holds the ſubſtance of light or fire to be the true chymic principle ſulphur * and to extend itſelf throughout the whole univerſe. It is his opinion that this is the only active principle. That mixed with various things it formeth ſeveral ſorts of natural productions. With ſalts making oil, with earth bitumen, with mercury metal. That this principle of ſulphur, fire, or the ſubſtance of light, is in itſelf imperceptible, and only becomes ſenſible, as it is joined with ſome other principle, which ſerves as a vehicle for it. That, although it be the moſt active of all things, yet it is at the ſame time the moſt firm bond and cement to combine and hold the principles together, and give form to the

* Sect. 129.

mixed

mixed bodies. And, that in the analyſis of bodies it is always loſt, eſcaping the ſkill of the artiſt, and paſſing through the cloſeſt veſſels.

190. Boerhaave, Niewenty't, and divers other moderns are in the ſame way of thinking. They with the ancients diſtinguiſh a pure elementary, inviſible fire from the culinary, or that which appears in ignited bodies*. This laſt they will not allow to be pure fire. The pure fire is to be diſcerned by its effects alone; ſuch as heat, dilatation of all ſolid bodies, and rarefaction of fluids, the ſegregating heterogeneous bodies, and congregating thoſe that are homogeneous. That therefore which ſmokes and flames is not pure fire, but that which is collected in the focus of a concave mirrour or burning glaſs. This fire ſeems the ſource of all the operations in nature: without it nothing either vegetates, or putrefies, lives or moves or ferments, is diſſolved or compounded or altered, throughout this whole natural world in which we ſubſiſt Were it not for this, the whole would be one great ſtupid inanimate maſs. But this active element is ſuppoſed to be every where, and always preſent, imparting different degrees of life, heat and motion, to the various animals, vegetables, and other natural productions, as well as to the elements themſelves, wherein they are produced and nouriſhed.

191. As water acts upon ſalt, or aqua fortis upon iron, ſo fire diſſolves all other bodies. Fire, air, and water are all three menſtruums: but the two laſt ſeem to derive all their force and activity from the firſt †. And indeed there ſeems to be, originally or ultimately, but one menſtruum in nature, to which all other menſtruums may be reduced. Acid ſalts are a menſtruum, but their force and diſtinct powers are from ſulphur. Conſidered as pure, or in themſelves, they are all of the ſame nature. But, as obtained by diſtillation, they are conſtantly joined with ſome ſulphur, which characterizeth and cannot be ſeparated from it. This is

* Sect. 163, 166. † Sect. 149.

the

the doctrine of Monſieur Homberg. But what is it that characterizeth or differenceth the ſulphurs themſelves? If ſulphur be the ſubſtance of light, as that author will have it, whence is it that animal, vegetable, and metallic ſulphurs impart different qualities to the ſame acid ſalt? Can this be explained upon Homberg's principles? And are we not obliged to ſuppoſe, that light ſeparated by the attracting and repelling powers in the ſtrainers, ducts, and pores of thoſe bodies, doth form ſeveral diſtinct kinds of ſulphur, all which, before ſuch ſeparation, were loſt and blended together, in one common maſs of light or fire, ſeemingly homogeneous.

192. In the analyſis of inflammable bodies, the fire or ſulphur is loſt, and the diminution of weight ſheweth the loſs *. Oil is reſolved into water, earth, and ſalt, none of which is inflammable. But the fire or vinculum which connected thoſe things, and gave the form of oil, eſcapes from the artiſt. It diſappears but is not deſtroyed. Light or fire impriſoned made part of the compound, gave union to the other parts, and form to the whole. But having eſcaped, it mingles with the general ocean of æther, till being again parted and attracted, it enters and ſpecificates ſome new ſubject, of the animal, vegetable, or mineral kingdom. Fire therefore in the ſenſe of philoſophers is always fire, though not always flame.

193. Solar fire or light, in calcining certain bodies, is obſerved to add to their weight. There is therefore no doubt but light can be fixed, and enter the compoſition of a body. And though it ſhould lie latent for a long time, yet, being ſet free from its priſon, it ſhall ſtill ſhew itſelf to be fire. Lead, tin, or regulus of antimony, being expoſed to the fire of a burning glaſs, though they loſe much in ſmoke and ſteam, are nevertheleſs found to be conſiderably increaſed in weight, which proves the intro-

* Sect. 169.

duction

duction of light or fire into their pores. It is alſo obſerved, that urine produceth no phoſphorus, unleſs it be long expoſed to the ſolar light. From all which it may be concluded, that bodies attract and fix the light, whence it ſhould ſeem, as ſome have obſerved, that fire without burning is an ingredient in many things, as water without wetting.

194. Of this there cannot be a better proof, than the experiment of Monſieur Homberg, who made gold of mercury by introducing light into its pores, but at ſuch trouble and expence, that I ſuppoſe nobody will try the experiment for profit. By this injunction of light and mercury, both bodies became fixed, and produced a third different from either, to wit, real gold. For the truth of which fact, I refer to the memoirs of the French academy of ſciences. From the foregoing experiment it appears, that gold is only a maſs of mercury penetrated and cemented by the ſubſtance of light, the particles of thoſe bodies attracting and fixing each other. This ſeems to have been not altogether unknown to former philoſophers, Marcilius Ficinus the Platoniſt, in his commentary on the firſt book of the ſecond Æneid of Plotinus, and others likewiſe before him, regarding mercury as the mother, and ſulphur as the father of metals; and Plato himſelf in his Timæus deſcribing gold, to be a denſe fluid with a ſhining yellow light, which well ſuits a compoſition of light and mercury.

195. Fire or light mixeth with all bodies *, even with water; witneſs the flaſhing lights in the ſea, whoſe waves ſeem frequently all on fire. Its operations are various according to its kind, quantity, and degree of vehemence. One degree keeps water fluid, another turns it into elaſtic air †. And air itſelf ſeems to be nothing elſe but vapours and exhalations, rendered elaſtic by fire. Nothing flames but oil: and ſulphur with

* Sect. 157. † Sect. 149.

water,

water, ſalt, and earth compoſe oil; which ſulphur is fire: therefore fire encloſed attracts fire, and cauſeth the bodies whoſe compoſition it enters to burn and blaze.

196. Fire collected in the focus of a glaſs operates in vacuo, and therefore is thought not to need air to ſupport it. Calx of lead hath gone off with an exploſion in vacuo, which Niewenty't and others take for a proof that fire can burn without air. But Mr. Hales attributes this effect to air encloſed in the red lead, and perhaps too in the receiver, which cannot be perfectly exhauſted. When common lead is put into the fire in order to make red lead, a greater weight of this comes out than was put in of common lead. Therefore the red lead ſhould ſeem impregnated with fire. Mr. Hales thinks it is with air. The vaſt expanſion of compound aqua fortis, Mr. Niewenty't will have to proceed from fire alone. Mr. Hales contends that air muſt neceſſarily cooperate. Though by Niewenty't's experiment it ſhould ſeem, the phoſphorus burns equally, with and without air.

197. Perhaps they who hold the oppoſite ſides in this queſtion, may be reconciled by obſerving that air is in reality nothing more than particles of wet and dry bodies volatilized and rendered elaſtic by fire *. Whatever, therefore, is done by air muſt be aſcribed to fire, which fire is a ſubtile inviſible thing, whoſe operation is not to be diſcerned but by means of ſome groſſer body, which ſerves not for a pabulum to nouriſh the fire, but for a vehicle to arreſt and bring it into view. Which ſeems the ſole uſe of oil, air, or any other thing, that vulgarly paſſeth for a pabulum or food of that element

198. To explain this matter more clearly, it is to be obſerved, that fire, in order to become ſenſible, muſt have ſome ſubject to act upon.

* Sect. 147, 150, 151.

This

This being penetrated and agitated by fire affects us with light, heat, or ſome other ſenſible alteration. And this ſubject ſo wrought upon may be called culinary fire. In the focus of a burning glaſs expoſed to the ſun, there is real actual fire though not diſcerned by the ſenſe, till it hath ſomewhat to work on, and can ſhew itſelf in its effects, heating, flaming, melting and the like. Every ignited body is, in the foregoing ſenſe, culinary fire. But it will not therefore follow, that it is convertible into pure elementary fire. This, for ought that appears, may be ingenerable and incorruptible by the courſe of nature. It may be fixed and impriſoned in a compound*, and yet retain its nature, though loſt to ſenſe, and though it return into the inviſible elementary maſs, upon the analyſis of the compounded body: as is manifeſt in the ſolution of ſtone lime by water.

199. It ſhould ſeem, therefore, that what is ſaid of air's being the pabulum of fire, or being converted into fire, ought to be underſtood only in this ſenſe; to wit, that air being leſs groſs than other bodies, is of a middle nature, and therefore more fit to receive the impreſſions of a fine ætherial fire †, and impart them to other things. According to the ancients, ſoul ſerveth for a vehicle to intellect ‡, and light or fire for a vehicle to the ſoul; and, in like manner, air may be ſuppoſed a vehicle to fire, fixing it in ſome degree, and communicating its effects to other bodies.

200. The pure inviſible fire or æther doth permeate all bodies, even the hardeſt and moſt ſolid as the diamond. This alone, therefore, cannot as ſome learned men have ſuppoſed, be the cauſe of muſcular motion, by a mere impulſe of the nerves communicated from the brain to the membranes of the muſcles, and thereby to the encloſed æther, whoſe expanſive motion, being by that means increaſed, is thought to

* Sect. 169, 192, 193 † Sect. 163. ‡ Sect. 178.

ſwell the muſcles and cauſe a contraction of the fleſhy fibres. This it ſhould ſeem, the pure æther cannot do immediately, and of itſelf, becauſe, ſuppoſing its expanſive motion to be increaſed, it muſt ſtill paſs through the membranes, and conſequently not ſwell them, inaſmuch as æther is ſuppoſed freely to pervade the moſt ſolid bodies. It ſhould ſeem therefore that this effect muſt be owing, not to pure æther, but to æther in ſome part fixed and arreſted by the particles of air.

201. Although this æther be extremely elaſtic, yet, as it is ſometimes found by experience to be attracted, impriſoned and detained in groſs bodies *, ſo we may ſuppoſe it to be attracted, and its expanſive force diminiſhed, though it ſhould not be quite fixed, by the looſe particles of air, which combining and cohering therewith may bring it down, and qualify it for intercourſe with groſſer things. Pure fire may be ſaid to animate air, and air other things. Pure fire is inviſible; therefore flame is not pure fire. Air is neceſſary both to life and flame. And it is found by experiment, that air loſeth in the lungs the power of feeding flame. Hence it is concluded, that the ſame thing in air contributes both to life and flame. Vital flame ſurvives culinary flame in vacuo: therefore it requires leſs of that thing to ſuſtain it.

202. What this may be, whether ſome certain proportion, or ſome peculiar parts of æther, is not eaſy to ſay. But thus much ſeems plain, that whatever is aſcribed to acid may be alſo aſcribed to fire or æther. The particles of æther fly aſunder with the greateſt force: therefore, agreeably to Sir Iſaac Newton's doctrine, when united they muſt attract each other with the greateſt force. Therefore they conſtitute the acid. For whatſoever ſtrongly attracts and is attracted, may be called an acid, as Sir Iſaac Newton informs us in his tract *de acido*. Hence it ſhould ſeem

* Sect. 169.

that

that the ſulphur of Homberg and the acid of Sir Iſaac are at bottom one and the ſame thing, to wit, pure fire or æther.

203. The vital flame or ætherial ſpirit, being attracted and impriſoned in groſſer bodies, ſeemeth to be ſet free and carried off, by the ſuperior attraction of a ſubtile and pure flame. Hence, perhaps it is, that lightening kills animals, and turns ſpirituous liquors vapid in an inſtant.

204. Hippocrates in his book concerning the heart obſerveth, that the ſoul of man is not nouriſhed by meats and drinks from the lower belly, but by a pure and luminous ſubſtance darting its rays, and diſtributing a non natural nouriſhment, as he terms it, in like manner as that from the inteſtines is diſtributed to all parts of the body. This luminous non natural nouriſhment, though it be ſecreted from the blood, is expreſly ſaid not to come from the lower belly. It is plain, therefore, he thought it came into the blood either by reſpiration, or by attraction through the pores. And it muſt be acknowledged, that ſomewhat igneous or æthereal brought by the air into the blood ſeems to nouriſh, though not the ſoul itſelf, yet the interior tunicle of the ſoul, the auraï *ſimplicis ignem.*

205. That there is really ſuch a thing as vital flame, actually kindled, nouriſhed and extinguiſhed like common flame, and by the ſame means, is an opinion of ſome moderns, particularly of Dr. Willis in his tract *de ſanguinis accenſione:* that it requires conſtant evantilation, through the trachæa and pores of the body for the diſcharge of a fuliginous and excrementitious vapour: and that this vital flame, being extremely ſubtile, might not be ſeen any more than ſhining flies or *ignes fatui* by day-light. And yet it hath ſometimes become viſible on divers perſons, of which there are undoubted inſtances. This is Dr. Willis's notion: and perhaps there may be ſome truth in this, if it be ſo underſtood, as that light or

fire might indeed conſtitute the animal ſpirit or immediate vehicle of the ſoul.

206. There have not been wanting thoſe, who, not content to ſuppoſe light the moſt pure and refined of all corporeal beings, have gone farther, and beſtowed upon it ſome attributes of a yet higher nature. Julianus the Platonic philoſopher, as cited by Ficinus, ſaith it was a doctrine in the theology of the Phœnicians, that there is diffuſed throughout the univerſe, a pellucid and ſhining nature pure and impaſſive, the act of a pure intelligence. And Ficinus himſelf undertakes to prove, that light is incorporeal, by ſeveral arguments: becauſe it enlightens and fills a great ſpace in an inſtant, and without oppoſition: becauſe ſeveral lights meet without reſiſting each other: becauſe light cannot be defiled by filth of any kind: becauſe the ſolar light is not fixed in any ſubject: laſtly, becauſe it contracts and expands itſelf ſo eaſily without colliſion, condenſation, rarefaction, or delay throughout the vaſteſt ſpace. Theſe reaſons are given by Ficinus, in his comment on the firſt book of the ſecond Æneid of Plotinus.

207. But it is now well known, that light moves, and that its motion is not inſtantaneous: that it is capable of condenſation, rarefaction, and colliſion: that it can be mixed with other bodies, enter their compoſition, and increaſe their weight *. All which ſeems ſufficiently to overthrow thoſe arguments of Ficinus, and ſhew light to be corporeal. There appears indeed ſome difficulty at firſt ſight, about the non reſiſtance of rays or particles of light occurring one to another, in all poſſible directions or from all points. Particularly, if we ſuppoſe the hollow ſurface of a large ſphere, ſtudded with eyes looking inwards one at another, it may perhaps ſeem hard to conceive, how diſtinct rays from every eye ſhould arrive at every other eye without juſtling, repelling, and confounding each other.

* Sect. 169, 192, 193.

208. But

208. But theſe difficulties may be got over by conſidering in the firſt place, that viſible points are not mathematical points, and conſequently that we are not to ſuppoſe every point of ſpace a radiating point. Secondly, by granting that many rays do reſiſt and intercept each other, notwithſtanding which the act of viſion may be performed. Since as every point of the object is not ſeen, ſo it is not neceſſary that rays from every ſuch point arrive at the eye. We often ſee an object, though more dimly, when many rays are intercepted by a groſs medium.

209. Beſides, we may ſuppoſe the particles of light to be indefinitely ſmall, that is as ſmall as we pleaſe, and their aggregate to bear as ſmall a proportion to the void as we pleaſe, there being nothing in this that contradicts the phænomena. And there needs nothing more, in order to conceive the poſſibility of rays paſſing from and to all viſible points, although they be not incorporeal. Suppoſe a hundred ports placed round a circular ſea, and ſhips ſailing from each port to every other; the larger the ſea, and the ſmaller the veſſels are ſuppoſed, the leſs danger will there be of their ſtriking againſt each other. But as there is by hypotheſis no limited proportion between the ſea and the ſhips, the void and ſolid particles of light, ſo there is no difficulty that can oblige us to conclude the ſun's light incorporeal from its free paſſage; eſpecially when there are ſo many clear proofs of the contrary. As for the difficulty, therefore, attending the ſuppoſition of a ſphere ſtudded with eyes looking at each other, this is removed only by ſuppoſing the particles of light exceeding ſmall relatively to the empty ſpaces.

210. Plotinus ſuppoſeth, that from the ſun's light which is corporeal, there ſprings forth another equivocal light which is incorporeal, and as it were the brightneſs of the former. Marcilius Ficinus alſo obſerving it to be a doctrine in the Timæus of Plato that there is an occult fire or ſpirit diffuſed throughout the univerſe, intimates that this ſame occult inviſible

inviſible fire or light is, as it were, the ſight of the mundane ſoul. And Plotinus in his fourth Æneid ſheweth it to be his opinion, that the world ſeeth itſelf and all its parts. The Platonic philoſophers do wonderfully refine upon light, and ſoar very high: from coal to flame; from flame to light: from this viſible light to the occult light of the celeſtial or mundane ſoul, which they ſuppoſed to pervade and agitate the ſubſtance of the univerſe by its vigorous and expanſive motion.

211. If we may believe Diogenes Laertius, the Pythagorean philoſophers thought there was a certain pure heat or fire, which had ſomewhat divine in it, by the participation whereof men became allied to the Gods. And according to the Platoniſts, heaven is not defined ſo much by its local ſituation, as by its purity. The pureſt and moſt excellent fire, that is heaven, ſaith Ficinus. And again, the hidden fire that every where exerts itſelf, he calls celeſtial. He repreſents fire as moſt powerful and active, dividing all things, abhorring all compoſition or mixture with other bodies. And, as ſoon as it gets free, relapſing inſtantly into the common maſs of celeſtial fire, which is every where preſent and latent.

212. This is the general ſource of life, ſpirit, and ſtrength, and therefore, of health to all animals, who conſtantly receive its illapſes cloathed in air, through the lungs and pores of the body. The ſame ſpirit impriſoned in food and medicines, is conveyed into the ſtomach, the bowels, the lacteals, circulated and ſecreted by the ſeveral ducts, and diſtributed throughout the ſyſtem*. Plato in his Timæus enumerating the ignited juices, names wine in the firſt place, and tar in the ſecond. But wine is preſſed from the grape, and fermented by human induſtry. Therefore of all ignited juices purely natural, tar or reſin muſt in his account be eſteemed the firſt.

* Sect. 37, 42, 44.

213. The

213. The vivifying luminous æther exiſts in all places, even the darkeſt caverns, as is evident from hence, that many animals ſee in thoſe dark places, and that fire may be kindled in them by the colliſion or attrition of bodies. It is alſo known that certain perſons have fits of ſeeing in the dark. Tiberius was ſaid to have had this faculty or diſtemper. I myſelf knew an ingenious man who had experienced it ſeveral times in himſelf. And Dr. Willis in his tract *de ſanguinis accentione* mentions another of his own knowledge. This luminous æther or ſpirit is therefore ſaid by Virgil, to nouriſh or cheriſh the innermoſt earth, as well as the heavens and celeſtial bodies.

Principo cælum ac terras, campoſque liquentes.
Lucentemque globum Lunæ, Titaniaque aſtra
Spiritus in tus alit.

214. The principles of motion and vegetation in living bodies ſeem to be deliberations from the inviſible fire or ſpirit of the univerſe *. Which, though preſent to all things, is not nevertheleſs one way received by all; but variouſly imbibed, attracted, and ſecreted by the fine capillaries, and exquiſite ſtrainers in the bodies of plants and animals, whereby it becomes mixed and detained in their juices.

215. It hath been thought by ſome obſervers of nature, that the fine glandular veſſels admit from the common maſs of the blood, only ſuch juices as are homogeneous to thoſe, with which they were originally imbued. How they came to be ſo imbued doth not appear. But thus much is plain; that fine tubes attract fluids, that the glands are fine tubes, and that they attract very different juices from the common maſs. The ſame holds alſo with regard to the capillary veſſels † of vegetables, it being evident that through the fine ſtrainers in the leaves and all over

* Sect. 43, 157, 164, 171. † Sect. 30, 31, 33, 35.

the

the body of the plant, there be juices or fluids of a particular kind drawn in, and ſeparated from the common maſs of air and light. And that the moſt elaborate ſpirit, whereon the character or diſtinguiſhing virtue and properties of the plant depend, is of a luminous * and volatile nature, being loſt or eſcaping into air or æther, from eſſential oils and odoriferous waters, without any ſenſible diminution of them.

216. As different kinds of ſecreted light or fire produce different eſſences, virtues, or ſpecific properties, ſo alſo different degrees of heat produce different effects. Thus one degree of heat keeps the blood from coagulating, and another degree coagulates the blood. Thus a more violent fire hath been obſerved to ſet free and carry off that very light, which a more moderate fire had introduced and fixed in the calcined regulus of antimony. In like manner, one kind or quantity of this ætherial fiery ſpirit may be congenial and friendly to the ſpirits of a man, while another may be noxious.

217. And experience ſheweth this to be true. For the fermented ſpirit of wine or other liquors produceth irregular motions, and ſubſequent depreſſions in the animal ſpirits. Whereas the luminous ſpirit lodged and detained in the native balſam of pines and firs, is of a nature ſo mild and benign and proportioned to the human conſtitution, as to warm without heating, to cheer but not inebriate, and to produce a calm and ſteady joy like the effect of good news, without that ſinking of ſpirits which is a ſubſequent effect of all fermented cordials. I may add, without all other inconvenience, except that it may like any other medicine be taken in too great a quantity for a nice ſtomach. In which caſe it may be right, to leſſen the doſe, or to take it only once in the four and twenty hours, empty, going to bed (when it is found to be leaſt offenſive,) or even

* Sect. 37, 43.

to

to ſuſpend the taking of it for a time, till nature ſhall ſeem to crave it, and rejoice in its benign and comfortable ſpirit.

218. Tar water ſerving as a vehicle to this ſpirit is both diuretic and diaphoretic, but ſeems to work its principal effect by aſſiſting the *vis vitæ*, as an alterative and cordial, enabling nature by an acceſſion of congenial ſpirit, to aſſimilate that which could not be aſſimilated by her proper force, and ſo to ſubdue the *fomes morbi*. And this ſhould ſeem in moſt caſes the beſt and ſafeſt courſe. Great evacuations weaken nature as well as the diſeaſe. And it is to be feared that they who uſe ſalivations and copious bleedings, may, though they ſhould recover of the diſtemper, in their whole life be never able to recover of the remedies.

219. It is true indeed, that in chronical caſes there is need of time to complete a cure, and yet I have known this tar-water in diſorders of the lungs and ſtomach to prove a very ſpeedy remedy, and to allay the anxiety and heat of a fever in an inſtant, giving eaſe and ſpirits to the patient. This I have often experienced, not without ſurpriſe at ſeeing theſe ſalutary effects follow ſo immediately in a fever on taking a glaſs of tar water. Such is the force of theſe active vivifying principles contained in this balſam.

220. Force or power, ſtrictly ſpeaking, is in the agent alone who imparts an equivocal force to the inviſible elementary fire, or animal ſpirit* of the world, and this to the ignited body or viſible flame, which produceth the ſenſe of light and heat. In this chain the firſt and laſt links are allowed to be incorporeal: the two intermediate are corporeal, being capable of motion, rarefaction, gravity, and other qualities of bodies. It is fit to diſtinguiſh theſe things, in order to avoid ambiguity concerning the nature of fire.

* Sect. 153, 156, 157.

221. Sir Iſaac Newton in his optics, aſks; Is not fire a body heated ſo hot as to emit light copiouſly? for what elſe, adds he, is a red hot iron than fire? Now it ſhould ſeem, that to define fire by heat, would be to explain a thing by itſelf. A body heated ſo hot as to emit light is an ignited body, that is, hath fire in it, is penetrated and agitated by fire, but is not itſelf fire. And although it ſhould in the third foregoing acceptation, or vulgar ſenſe paſs for fire, yet it is not the pure elementary * fire in the ſecond or philoſophic ſenſe, ſuch as was underſtood by the ſages of antiquity, and ſuch as is collected in the focus of a burning glaſs; much leſs is it the vis, force, or power of burning, deſtroying, calcining, melting, vitrifying, and raiſing the perceptions of light and heat. This is truly and really in the incorporeal agent, and not in the vital ſpirit of the univerſe. Motion, and even power in an equivocal ſenſe, may be found in this pure ætherial ſpirit, which ignites bodies, but is not itſelf the ignited body, being an inſtrument or medium † by which the real agent doth operate on groſſer bodies.

222. It hath been ſhewed in Sir Iſaac Newton's optics, that light is not reflected by impinging on bodies, but by ſome other cauſe. And to him it ſeems probable, that as many rays as impinge on the ſolid parts of bodies, are not reflected but ſtifled and retained in the bodies. And it is certain, the great poroſity of all known bodies affords room for much of this light or fire to be lodged therein. Gold itſelf the moſt ſolid of all metals, ſeems to have far more pores than ſolid parts, from water being preſſed through it in the Florentine experiment, from magnetic effluvia paſſing, and from mercury entering its pores ſo freely. And it is admitted that water though impoſſible to be compreſſed hath at leaſt forty times more pores than ſolid parts. And as acid particles, joined with thoſe of earth in certain proportions, are ſo cloſely united with them, as to be quite hid and loſt to all appearance, as in *mercurius dulcis*

* Sect. 190. † Sect. 160.

and

and common ſulphur, ſo alſo may we conceive the particles of light or fire to be abſorbed and latent in groſſer bodies.

223. It is the opinion of Sir Iſaac Newton, that ſomewhat unknown remains in vacuo, when the air is exhauſted. This unknown medium he calls æther. He ſuppoſeth it to be more ſubtile in its nature, and more ſwift in its motion than light, freely to pervade all bodies, and by its immenſe elaſticity to be expanded throughout all the heavens. Its denſity is ſuppoſed greater in free and open ſpaces, than within the pores of compact bodies. And, in paſſing from the celeſtial bodies to great diſtances, it is ſuppoſed to grow denſer and denſer continually; and thereby cauſe thoſe great bodies to gravitate towards one another, and their reſpective parts towards their centers, every body endeavouring to paſs from the denſer parts of the medium towards the rarer.

224. The extreme minuteneſs of the parts of this medium and the veloſity of their motion, together with its gravity, denſity and elaſtic force, are thought to qualify it for being the cauſe of all the natural motions in the univerſe. To this cauſe are aſcribed the gravity and coheſion of bodies. The refraction of light is alſo thought to proceed from the different denſity and elaſtic force of this ætherial medium in different places. The vibrations of this medium alternately concurring with, or obſtructing the motions of the rays of light, are ſuppoſed to produce the fits of eaſy reflexion and tranſmiſſion. Light by the vibrations of this medium is thought to communicate heat to bodies. Animal motion and ſenſation are alſo accounted for by the vibrating motions of this ætherial medium, propagated through the ſolid capillaments of the nerves. In a word, all the phænomena and properties of bodies, that were before attributed to attraction, upon later thoughts ſeem aſcribed to this æther, together with the various attractions themſelves.

225. But in the philoſophy of Sir Iſaac Newton, the fits (as they are called) of eaſy tranſmiſſion and reflexion, ſeem as well accounted for by vibrations excited in bodies by the rays of light; and the refraction of light by the attraction of bodies. To explain the vibrations of light by thoſe of a more ſubtile medium, ſeems an uncouth explication. And gravity ſeems not an effect of the denſity and elaſticity of æther, but rather to be produced by ſome other cauſe; which Sir Iſaac himſelf inſinuates to have been the opinion even of thoſe ancients who took vacuum, atoms, and the gravity of atoms for the principles of their philoſophy, tacitly attributing (as he well obſerves) gravity to have ſome other cauſe diſtinct from matter, from atoms and conſequently, from that homogeneous æther or elaſtic fluid. The elaſticity of which fluid is ſuppoſed to depend upon, to be defined and meaſured by its denſity; and this by the quantity of matter in one particle, multiplied by the number of particles contained in a given ſpace; and the quantity of matter in any one particle to be determined by its gravity. Should not therefore gravity ſeem the original property and firſt ſuppoſed? On the other hand, if force be conſidered as preſcinded from gravity and matter, and as exiſting only in points or centers, what can this amount to but an abſtract ſpiritual incorporeal force?

226. It doth not ſeem neceſſary from the phænomena, to ſuppoſe any medium more active and ſubtile than light or fire. Light being allowed to move at the rate of about ten millions of miles in a minute, what occaſion is there to conceive another medium of ſtill ſmaller and more movable parts. Light or fire ſeem the ſame with æther. So the ancients underſtood, and ſo the Greek word implies. It pervades all things*, is every where preſent. And this ſame ſubtile medium according to its various quantities, motions and determinations, ſheweth itſelf in different effects or appearances, and is æther, light or fire.

* Sect. 157.

227. The

227. The particles of æther fly aſunder with the greateſt force, therefore, when united they muſt (according to the Newtonian doctrine) attract each other with the greateſt force; therefore they are acids * or conſtitute the acid; but this united with earthy parts maketh alkali, as Sir Iſaac teacheth in his tract *de acido*; alkali, as appears in cantharides and lixivial ſalts, is a cauſtic; cauſtics are fire; therefore acid is fire; therefore æther is fire; and if fire, light. We are not therefore obliged to admit a new medium diſtinct from light, and of a finer and more exquiſite ſubſtance, for the explication of phænomena, which appear to be as well explained without it. How can the denſity or elaſticity of æther account for the rapid flight of a ray of light from the ſun, ſtill ſwifter as it goes farther from the ſun? or how can it account for the various motions and attractions of different bodies? Why oil and water, mercury and iron repel, or why other bodies attract each other? or why a particle of light ſhould repel on one ſide and attract on the other, as in the caſe of the iſlandic cryſtal? To explain coheſion by hamate atoms is accounted *ignotum per ignotius*. And is it not as much ſo to account for the gravity of bodies by the elaſticity of æther?

228. It is one thing to arrive at general laws of nature from a contemplation of the phænomena; and another to frame an hypotheſis, and from thence deduce the phænomena. Thoſe who ſuppoſe epicycles, and by them explain the motions and appearances of the planets, may not therefore be thought to have diſcovered principles true in fact and nature. And albeit we may from the premiſes infer a concluſion, it will not follow, that we can argue reciprocally, and from the concluſion infer the premiſes. For inſtance, ſuppoſing an elaſtic fluid, whoſe conſtituent minute particles are equidiſtant from each other and of equal denſities and diameters, and recede one from another with a centrifugal force which is inverſly as the diſtance of the centers, and admitting that from ſuch ſuppoſition it muſt follow, that the denſity and elaſtic force of ſuch

* Sect. 130.

fluid

fluid are in the inverſe proportion of the ſpace it occupies when compreſſed by any force; yet we cannot reciprocally infer, that a fluid endued with this property muſt therefore conſiſt of ſuch ſuppoſed equal particles; for it would then follow, that the conſtituent particles of air were of equal denſities and diameters; whereas it is certain, that air is an heterogeneous maſs, containing in its compoſition an infinite variety of exhalations, from the different bodies which make up this terraqueous globe.

229. The phænomena of light, animal ſpirit, muſcular motion, fermentation, vegetation, and other natural operations, ſeem to require nothing more than the intellectual and artificial fire of Heraclitus, Hippocrates, the Stoics *, and other ancients. Intellect, ſuperadded to æthereal ſpirit, fire, or light, moves, and moves regularly, proceeding, in a method, as the Stoics, or increaſing and diminiſhing by meaſure, as Heraclitus expreſſed it. The Stoics held that fire comprehended and included the ſpermatic reaſons or forms (λόγους σπερματικοὺς) of all natural things. As the forms of things have their ideal exiſtence in the intellect, ſo it ſhould ſeem that ſeminal principles have their natural exiſtence in the light †, a medium conſiſting of heterogeneous parts, differing from each other in divers qualities that appear to ſenſe, and not improbably having many original properties, attractions, repulſions and motions, the laws and natures whereof are indiſcernible to us, otherwiſe than in their remote effects. And this animated heterogeneous fire ſhould ſeem a more adequate cauſe, whereby to explain the phænomena of nature, than one uniform ætherial medium.

230. Ariſtotle indeed excepts againſt the elements being animated. Yet nothing hinders why that power of the ſoul, ſtyled by him κινητικὴ or locomotive, may not reſide therein, under the direction of an intellect,

* Sect. 166, 168. † Sect. 164.

in

in ſuch ſenſe and as properly as it is ſaid to reſide in animal bodies. It muſt nevertheleſs be owned, that albeit that philoſopher acknowledgeth a divine force or energy in fire, yet to ſay that fire is alive, or that having a ſoul it ſhould not be alive, ſeem to him equally abſurd. See his ſecond book, *de partibus animalium.*

231. The laws of attraction and repulſion are to be regarded as laws of motion, and theſe only as rules or methods obſerved in the productions of natural effects, the efficient and final cauſes whereof are not of mechanical conſideration. Certainly, if the explaining a phænomenon be to aſſign its proper efficient and final cauſe *, it ſhould ſeem the mechanical philoſophers never explained any thing; their province being only to diſcover the laws of nature, that is the general rules and methods of motion, and to account for particular phænomena by reducing them under, or ſhewing their conformity to ſuch general rules.

232. Some corpuſcularian philoſophers of the laſt age, have indeed attempted to explain the formation of this world and its phænomena, by a few ſimple laws of mechaniſm. But if we conſider the various productions of nature, in the mineral, vegetable, and animal parts of the creation, I believe we ſhall ſee cauſe to affirm, that not any one of them has hitherto been, or can be accounted for on principles merely mechanical; and that nothing could be more vain and imaginary, than to ſuppoſe with Deſcartes, that merely from a circular motion's being impreſſed by the ſupreme agent on the particles of extended ſubſtance, the whole world with all its ſeveral parts, appurtenances, and phænomena might be produced, by a neceſſary conſequence from the laws of motion.

233. Others ſuppoſe that God did more at the beginning, having then made the ſeeds of all vegetables and animals, containing their ſolid or-

* Sect. 154, 155, 160.

ganical

ganical parts in miniature, the gradual filling and evolution of which, by the influx of proper juices, doth conſtitute the generation and growth of a living body. So that the artificial ſtructure of plants and animals daily generated, requires no preſent exerciſe of art to produce it, having been already framed at the origin of the world, which with all its parts hath ever ſince ſubſiſted, going like a clock or machine by itſelf, according to the laws of nature, without the immediate hand of the artiſt. But how can this hypotheſis explain the blended features of different ſpecies in mules and other mongrels? or the parts added or changed, and ſometimes whole limbs loſt by marking in the womb? or how can it account for the reſurrection of a tree from its ſtump, or the vegetative power in its cuttings? in which caſes we muſt neceſſarily conceive ſomething more than the mere evolution of a ſeed.

234. Mechanical laws of nature or motion direct us how to act, and teach us what to expect. Where intellect preſides there will be method and order, and therefore rules, which if not ſtated and conſtant would ceaſe to be rules. There is therefore a conſtancy in things, which is ſtyled the courſe of nature *. All the phænomena in nature are produced by motion. There appears an uniform working in things great and ſmall, by attracting and repelling forces. But the particular laws of attraction and repulſion are various. Nor are we concerned at all about the forces, neither can we know or meaſure them otherwiſe than by their effects, that is to ſay the motions, which motions only, and not the forces, are indeed in the bodies †. Bodies are moved to or from each other, and this is performed according to different laws. The natural or mechanic philoſopher endeavours to diſcover thoſe laws by experiment and reaſoning. But what is ſaid of forces reſiding in bodies, whether attracting or repelling, is to be regarded only as a mechanical hypotheſis, and not as any thing really exiſting in nature.

* Sect. 160. † Sect. 155.

235. We

235. We are not therefore ſeriouſly to ſuppoſe with certain mechanic philoſophers, that the minute particles of bodies have real forces or powers, by which they act on each other, to produce the various phænomena in nature. The minute corpuſcles are impelled and directed, that is to ſay, moved to and from each other according to various rules or laws of motion. The laws of gravity, magnetiſm, and electricity are divers. And it is not known, what other different rules or laws of motion might be eſtabliſhed, by the author of nature. Some bodies approach together, others fly aſunder, and perhaps ſome others do neither. When ſalt of tartar flows *per deliquium*, it is viſible that the particles of water floating in the air are moved towards the particles of ſalt, and joined with them. And when we behold vulgar ſalt not to flow *per deliquium*, may we not conclude that the ſame law of nature and motion doth not obtain between its particles and thoſe of the floating vapours? A drop of water aſſumes a round figure, becauſe its parts are moved towards each other. But the particles of oil and vinegar have no ſuch diſpoſition to unite. And when flies walk in water without wetting their feet, it is attributed to a repelling force or faculty in the flie's feet. But this is obſcure, though the phænomenon be plain.

236. It is not improbable, and ſeems not unſupported by experiments, that, as in algebra, where poſitive quantities ceaſe there negative begin, even ſo in mechanics, where attracting forces ceaſe there repelling forces begin: or (to expreſs it more properly) where bodies ceaſe to be moved towards, they begin to be moved from each other. This Sir Iſaac Newton infers from the production of air and vapours, whoſe particles fly aſunder with ſuch vehement force. We behold iron move towards the loadſtone, ſtraws towards amber, heavy bodies towards the earth. The laws of theſe motions are various. And when it is ſaid, that all the motions and changes in the great world ariſe from attraction; the elaſticity of the air, the motion of water, the deſcent of heavy, and

the aſcent of light bodies, being all aſcribed to the ſame principle; when from inſenſible attractions of moſt minute particles at the ſmalleſt diſtance, are derived coheſion, diſſolution, coagulation, animal ſecretion, fermentation, and all chymical operations; and when it is ſaid, that without ſuch principles there never would have been any motion in the world, and without the continuance thereof all motion would ceaſe. In all this we know or underſtand no more, than that bodies are moved according to a certain order, and that they do not move themſelves.

237. So likewiſe, how to explain all thoſe various motions and effects, by the denſity and elaſticity of æther, ſeems incomprehenſible *. For inſtance, why ſhould the acid particles draw thoſe of water and repel each other? why ſhould ſome ſalts attract vapours in the air, and others not? why ſhould the particles of common ſalt repel each other, ſo as not to ſubſide in water? why ſhould the moſt repellent particles be the moſt attractive upon contact? Or why ſhould the repellent begin where the attractive faculty leaves off. Theſe, and numberleſs other effects ſeem inexplicable on mechanical principles, or otherwiſe than by recourſe to a mind or ſpiritual agent †. Nor will it ſuffice from preſent phænomena and effects, through a chain of natural cauſes, and ſubordinate blind agents, to trace a divine intellect as the remote original cauſe, that firſt created the world, and then ſet it a going. We cannot make even one ſingle ſtep in accounting for the phænomena, without admitting the immediate preſence and immediate action of an incorporeal agent, who connects, moves, and diſpoſes all things, according to ſuch rules, and for ſuch purpoſes as ſeem good to him.

238. It is an old opinion adopted by the moderns, that the elements and other natural bodies are changed each into other ‡. Now, as the particles of different bodies are agitated by different forces, attracting

* Sect. 153, 162. † Sect. 154, 220. ‡ Sect. 148.

and

and repelling, or, to ſpeak more accurately, are moved by different laws, how can theſe forces or laws be changed, and this change accounted for by an elaſtic æther? Such a medium diſtinct from light or fire ſeemeth not to be made out by any proof, nor to be of any uſe in explaining the phænomena. But if there be any medium employed, as a ſubordinate cauſe or inſtrument in attraction, it would rather ſeem to be light *; ſince by an experiment of Mr. Boyle's, amber, that ſhewed no ſign of attraction in the ſhade, being placed where the ſun-beams ſhone upon it, immediately attracted light bodies. Beſides, it hath been diſcovered by Sir Iſaac Newton, and an admirable diſcovery it was, that light is an heterogeneous medium † conſiſting of particles endued with original diſtinct properties. And upon theſe, if I may venture to give my conjectures, it ſeemeth probable the ſpecific properties of bodies, and the force of ſpecific medicines may depend. Different ſides of the ſame ray ſhall, one approach and the other recede from the iſlandic cryſtal; can this be accounted for by the elaſticity of a fine medium, or by the general laws of motion, or by any mechanical principles whatever? And if not, what ſhould hinder but there may be ſpecific medicines, whoſe operation depends not upon mechanical principles, how much ſoever that notion hath been exploded of late years?

239. Why may we not ſuppoſe certain idioſyncraſies, ſympathies, oppoſitions, in the ſolids or fluids or animal ſpirit of a human body, with regard to the fine inſenſible parts of minerals or vegetables, impregnated by rays of light of different properties, not depending on, the different ſize, figure, number, ſolidity or weight of thoſe particles, nor on the general laws of motion, nor on the denſity or elaſticity of a medium, but merely and altogether on the good pleaſure of the Creator, in the original formation of things? From whence divers unaccountable and unforeſeen motions may ariſe in the animal œconomy; from whence alſo

* Sect. 152, 156. † Sect. 40, 181.

various peculiar and ſpecific virtues may be conceived to ariſe, reſiding in certain medicines and not to be explained by mechanical principles. For although the general known laws of motion are to be deemed mechanical, yet peculiar motions of the inſenſible parts, and peculiar properties depending thereon, are occult and ſpecific.

240. The words attraction and repulſion may, in compliance with cuſtom, be uſed where, accurately ſpeaking, motion alone is meant. And in that ſenſe it may be ſaid, that peculiar attractions or repulſions in the parts, are attended with ſpecific properties in the whole. The particles of light are vehemently moved to or from, retained or rejected by objects. Which is the ſame thing as to ſay with Sir Iſaac Newton, that the particles of acids are endued with great attractive force *, wherein their activity conſiſts; whence fermentation and diſſolution; and that the moſt repellent are, upon contact, the moſt attracting particles.

241. Gravity and fermentation are received for two moſt extenſive principles. From fermentation are derived the motion and warmth of the heart and blood in animals, ſubterraneous heat, fires, and earthquakes, meteors and changes in the atmoſphere. And, that attracting and repelling forces operate in the nutrition and diſſolution of animal and vegetable bodies, is the doctrine both of Hippocrates and Sir Iſaac Newton. The former of theſe celebrated authors, in his treatiſe concerning diet or regimen, obſerves that in the nouriſhment of man, one part repels and another attracts. And again in the ſame treatiſe, two carpenters, ſaith he, ſaw a piece of timber: one draws, the other puſhes: theſe two actions tend to one and the ſame end, though in a contrary direction, one up, the other down: this imitates the nature of man: πνεῦμα τὸ μὲν ἕλκει τὸ δὲ ὠθέει.

* Sect. 202.

242. It

242. It is the general maxim of Hippocrates, that the manner wherein nature acts conſiſteth in attracting what is meet and good, and in repelling what is diſagreeable or hurtful. He makes the whole of the animal œconomy to be adminiſtered by the faculties or powers of nature. Nature alone, ſaith he, ſufficeth for all things to animals. She knows of herſelf what is neceſſary for them. Whence it is plain, he means a conſcious intelligent nature, that preſides and moves the ætherial ſpirit. And though he declares all things are accompliſhed on man by neceſſity, yet it is not a blind fate or chain of mere corporeal cauſes, but a divine neceſſity, as he himſelf expreſly calls it. And what is this but an overruling intelligent power that diſpoſeth of all things?

243. Attraction cannot produce, and in that ſenſe account for the phænomena, being itſelf one of the phænomena produced and to be accounted for *. Attraction is performed by different laws, and cannot therefore in all caſes be the effect of the elaſticity of one uniform medium. The phænomena of electrical bodies, the laws and variations of magnetiſm, and, not to mention other kinds, even gravity, is not explained by elaſticity, a phænomenon not leſs obſcure than itſelf. But then, although it ſhew not the agent, yet it ſheweth a rule and analogy in nature, to ſay, that the ſolid parts of animals are endued with attractive powers whereby from contiguous fluids they draw like to like; and that glands have peculiar powers attractive of peculiar juices †. Nature ſeems better known and explained by attractions and repulſions, than by thoſe other mechanical principles of ſize, figure, and the like: that is by Sir Iſaac Newton, than Deſcartes. And natural philoſophers excel, as they are more or leſs acquainted with the laws and methods obſerved by the author of nature.

* Sect. 160, 235. † Sect. 41.

244. The

244. The ſize and ſhape of particles and general laws of motion can never explain the ſecretions without the help of attraction, obſcure perhaps as to its cauſe, but clear as a law. Numberleſs inſtances of this might be given: Lemery the younger thought himſelf obliged to ſuppoſe, the particles of light or fire (contrary to all reaſon) to be of a very groſs kind, even greater than the pores of the burnt limeſtone, in order to account for their being detained or impriſoned therein; but this phænomenon is eaſily reduced to attraction. There would be no end of enumerating the like caſes. The activity and force of ætherial ſpirit or fire by the laws of attraction, is imparted to groſſer particles *, and thereby wonderfully ſupports the œconomy of living bodies. By ſuch peculiar compoſitions and attractions it ſeems to be effected, that denſer fluids can paſs where air itſelf cannot, (as oil through leather) and therefore through the niceſt and fineſt ſtrainers of an animal or vegetable.

245. The ancients had ſome general conception of attracting and repelling powers † as natural principles. Galilæi had particularly conſidered the attraction of gravity, and made ſome diſcovery of the laws thereof. But Sir Iſaac Newton by his ſingular penetration, profound knowledge in geometry and mechanics, and great exactneſs in experiments, hath caſt a new light on natural ſcience. The laws of attraction and repulſion were in many inſtances diſcovered, and firſt diſcovered by him. He ſhewed their general extent, and therewith as with a key opened ſeveral deep ſecrets of nature, in the knowledge whereof he ſeems to have made a greater progreſs, than all the ſects of corpuſcularians together had done before him. Nevertheleſs, the principle of attraction itſelf is not to be explained by phyſical or corporeal cauſes.

246. The Carteſians attempted to explain it by the niſus of a ſubtile element, receding from the center of its motion, and impelling groſſer

* Sect. 152, 163. † Sect. 241, 242.

bodies

bodies towards it. Sir Iſaac Newton in his later thoughts ſeems (as was before obſerved) to have adopted ſomewhat not altogether foreign from this notion, aſcribing that to his elaſtic medium * which Deſcartes did to his ſecond element. But the great men of antiquity reſolved gravity into the immediate action of an intelligent incorporeal being. To which alſo Sir Iſaac Newton himſelf atteſts and ſubſcribes, although he may perhaps ſometimes be thought to forget himſelf, in his manner of ſpeaking of phyſical agents, which in a ſtrict ſenſe are none at all; and in ſuppoſing real forces to exiſt in bodies, in which, to ſpeak truly, attraction and repulſion ſhould be conſidered only as tendencies or motions, that is, as mere effects, and their laws as laws of motion.

247. Though it be ſuppoſed the chief buſineſs of a natural philoſopher to trace out cauſes from the effects, yet this is to be underſtood not of agents † but of principles, that is of component parts, in one ſenſe, or of laws or rules in another. In ſtrict truth, all agents are incorporeal, and as ſuch are not properly of phyſical conſideration. The aſtronomer, therefore, the mechanic, or the chymiſt, not as ſuch, but by accident only, treat of real cauſes, agents or efficients. Neither doth it ſeem, as is ſuppoſed by the greateſt of mechanical philoſophers, that the true way of proceeding in their ſcience is, from known motions in nature to inveſtigate the moving forces. Foraſmuch as force is neither corporeal nor belongs to any corporeal thing ‡; nor yet to be diſcovered by experiments or mathematical reaſonings, which reach no farther than diſcernible effects, and motions in things paſſive and moved.

248. Vis or force is to the ſoul, what extenſion is to the body, ſaith St. Auguſtin, in his tract concerning the quantity of the ſoul; and without force there is nothing done or made, and conſequently there can be

* Sect. 237, 238. † Sect. 155. ‡ Sect. 220.

no

no agent. Authority is not to decide in this caſe. Let any one conſult his own notions and reaſon, as well as experience, concerning the origin of motion, and the reſpective natures, properties, and differences of ſoul and body, and he will, if I miſtake not, evidently perceive, that there is nothing active in the latter. Nor are they natural agents or corporeal forces, which make the particles of bodies to cohere. Nor is it the buſineſs of experimental philoſophers to find them out.

249. The mechanical philoſopher, as hath been already obſerved, enquires properly concerning the rules and modes of operation alone, and not concerning the cauſe, foraſmuch as nothing mechanical is or really can be a cauſe *. And although a mechanical or mathematical philoſopher may ſpeak of abſolute ſpace, abſolute motion, and of force as exiſting in bodies, cauſing ſuch motion and proportional thereto; yet what theſe forces are, which are ſuppoſed to be lodged in bodies, to be impreſſed on bodies, to be multiplied, divided, and communicated from one body to another, and which ſeem to animate bodies like abſtract ſpirits, or ſouls, hath been found very difficult, not to ſay impoſſible, for thinking men to conceive and explain, as may be ſeen by conſulting *Borellus de vi percuſſionis*, and *Torricelli* in his *lezioni academiche*, among other authors.

250. Nor, if we conſider the proclivity of mankind to realize their notions, will it ſeem ſtrange that mechanic philoſophers and geometricians ſhould, like other men, be miſled by prejudice, and take mathematical hypotheſes, for real beings exiſting in bodies, ſo far as even to make it the very aim and end of their ſcience to compute or meaſure thoſe phantoms; whereas it is very certain that nothing in truth

* Sect. 236, 247.

can

can be meaſured * or computed, beſides the very effects or motions themſelves. Sir Iſaac Newton aſks, have not the minute particles of bodies certain forces or powers by which they act on one another, as well as on the particles of light, for producing moſt of the phænomena in nature? But in reality, thoſe minute particles are only agitated according to certain laws of nature, by ſome other agent, wherein the force exiſts and not in them, which have only the motion; which motion in the body moved, the Peripatetics rightly judge to be a mere paſſion, but in the mover to be ἐνέργεια or act.

251. It paſſeth with many, I know not how, that mechanical principles give a clear ſolution of the phænomena. The Democritic hypotheſis, ſaith doctor Cudworth, doth much more handſomely and intelligibly ſolve the phænomena, than that of Ariſtotle and Plato. But things rightly conſidered, perhaps it will be found not to ſolve any phænomenon at all. For all phænomena are, to ſpeak truly, appearances in the ſoul or mind, and it hath never been explained, nor can it be explained, how external bodies, figures and motions ſhould produce an appearance in the mind. Theſe principles, therefore, do not ſolve, if by ſolving is meant aſſigning the real, either efficient or final cauſe of appearances, but only reduce them to general rules.

252. There is a certain analogy, conſtancy, and uniformity in the phænomena or appearances of nature, which are a foundation for general rules: and theſe are a grammar for the underſtanding of nature, or that ſeries of effects in the viſible world, whereby we are enabled to foreſee what will come to paſs, in the natural courſe of things. Plotinus obſerves, in his third Æneid, that the art of preſaging is in ſome ſort the reading of natural letters denoting order, and that ſo far forth as analogy

* This ſubject is handled at large in the Latin tract *de motu*.

obtains in the univerſe, there may be vaticination. And in reality, he that foretels the motions of the planets, or the effects of medicines, or the reſults of chymical or mechanical experiments, may be ſaid to do it by natural vaticination.

253. We know a thing when we underſtand it: and we underſtand it, when we can interpret or tell what it ſignifies. Strictly the ſenſe knows nothing. We perceive indeed ſounds by hearing, and characters by ſight. But we are not therefore ſaid to underſtand them. After the ſame manner, the phænomena of nature are alike viſible to all: but all have not alike learned the connexion of natural things, or underſtand what they ſignify, or know how to vaticinate by them. There is no queſtion, ſaith Socrates, in Theæteto, concerning that which is agreeable to each perſon; but concerning what will in time to come be agreeable, of which all men are not equally judges. He who foreknoweth what will be in every kind is the wiſeſt. According to Socrates, you and the cook may judge of a diſh on the table equally well, but while the diſh is making, the cook can better foretel what will enſue from this or that manner of compoſing it. Nor is this manner of reaſoning confined only to morals or politics; but extends alſo to natural ſcience.

254. As the natural connexion of ſigns with the things ſignified is regular and conſtant, it forms a ſort of rational diſcourſe * and is therefore the immediate effect of an intelligent cauſe. This is agreeable to the philoſophy of Plato, and other ancients. Plotinus indeed ſaith, that which acts naturally is not intellection, but a certain power of moving matter, which doth not know but only do. And it muſt be owned, that, as faculties are multiplied by philoſophers according to their operations, the will may be diſtinguiſhed from the intellect. But it will

* Sect. 152.

not

not therefore follow, that the will, which operates in the courſe of nature, is not conducted and applied by intellect, although it be granted that neither will underſtands, nor intellect wills. Therefore, the phænomena of nature, which ſtrike on the ſenſes and are underſtood by the mind, do form not only a magnificent ſpectacle, but alſo a moſt coherent, entertaining, and inſtructive diſcourſe; and to effect this, they are conducted, adjuſted, and ranged by the greateſt wiſdom. This language or diſcourſe is ſtudied with different attention, and interpreted with different degrees of ſkill. But ſo far as men have ſtudied and remarked its rules, and can interpret right, ſo far they may be ſaid to be knowing in nature. A beaſt is like a man who hears a ſtrange tongue, but underſtands nothing.

255. Nature, ſaith the learned doctor Cudworth, is not maſter of art or wiſdom: nature is *ratio merſa et confuſa*, reaſon immerged and plunged into matter, and as it were fuddled in it and confounded with it. But the formation of plants and animals, the motions of natural bodies, their various properties, appearances and viciſſitudes, in a word, the whole ſeries of things in this viſible world, which we call the courſe of nature, is ſo wiſely managed and carried on, that the moſt improved human reaſon cannot thoroughly comprehend even the leaſt particle thereof; ſo far is it from ſeeming to be produced by fuddled or confounded reaſon.

256. Natural productions, it is true, are not all equally perfect. But neither doth it ſuit with the order of things, the ſtructure of the univerſe, or the ends of Providence that they ſhould be ſo. General rules, we have ſeen *, are neceſſary to make the world intelligible: and from the conſtant obſervations of ſuch rules, natural evils will ſometimes un-

* Sect. 249, 252.

avoidably enſue: things will be produced in a ſlow length of time, and arrive at different degrees of perfection.

257. It muſt be owned, we are not conſcious of the ſyſtole and diaſtole of the heart, or the motion of the diaphragm. It may not nevertheleſs be thence inferred, that unknowing nature can act regularly, as well as ourſelves. The true inference is, that the ſelf thinking individual, or human perſon is not the real author of thoſe natural motions. And in fact no man blames himſelf if they are wrong, or values himſelf if they are right. The ſame may be ſaid of the fingers of a muſician, which ſome object to be moved by habit which underſtands not; it being evident, that what is done by rule muſt proceed from ſomething that underſtands the rule; therefore, if not from the muſician himſelf, from ſome other active intelligence, the ſame perhaps which governs bees and ſpiders, and moves the limbs of thoſe who walk in their ſleep.

258. Inſtruments, occaſions, and ſigns * occur in, or rather make up, the whole viſible courſe of nature. Theſe, being no agents themſelves, are under the direction of one agent concerting all for one end, the ſupreme good. All thoſe motions, whether in animal bodies or in other parts of the ſyſtem of nature, which are not effects of particular wills, ſeem to ſpring from the ſame general cauſe with the vegetation of plants, an ætherial ſpirit actuated by a mind.

259. The firſt poets and theologers of Greece and the Eaſt conſidered the generation of things, as aſcribed rather to a divine cauſe, but the Phyſici to natural cauſes ſubordinate to, and directed ſtill by a divine; except ſome corporealiſts and mechanics who vainly pretended to make a world without a God. The hidden force that unites, adjuſts, and cauſeth all things to hang together, and move in harmony, which Or-

* Sect. 160.

pheus

pheus and Empedocles ſtyled love; this principle of union is no blind principle, but acts with intellect. This divine love and intellect are not themſelves obvious to our view, or otherwiſe diſcerned than in their effects. Intellect enlightens, love connects, and the ſovereign good attracts all things.

260. All things are made for the ſupreme good, all things tend to that end: and we may be ſaid to account for a thing, when we ſhew that it is ſo beſt. In the Phædon, Socrates declares it to be his opinion, that he, who ſuppoſed all things to have been diſpoſed and ordered by a mind *, ſhould not pretend to aſſign any other cauſe of them. He blames phyſiologers for attempting to account for phænomena, particularly for gravity and coheſion, by vortexes and æther, over looking the τὸ ἀγαθὸν and τὸ δέον, the ſtrongeſt bond and cement which holds together all the parts of the univerſe, and not diſcerning the cauſe itſelf from thoſe things which only attend it.

261. As in the microcoſm, the conſtant regular tenor of the motions of the viſcera, and contained juices doth not hinder, particular voluntary motions to be impreſſed by the mind on the animal ſpirit; even ſo in the mundane ſyſtem, the ſteady obſervance of certain laws of nature, in the groſſer maſſes and more conſpicuous motions, doth not hinder, but a voluntary agent may ſometimes communicate particular impreſſions to the fine ætherial medium, which in the world anſwers the animal ſpirit in man. Which two (if they are two) although inviſible and inconceivably ſmall, yet ſeem the real latent ſprings, whereby all the parts of this viſible world are moved; albeit they are not to be regarded as a true cauſe, but only an inſtrument of motion; and the inſtrument not as a help to the Creator, but only as a ſign to the creature.

* Sect. 154, 160.

262. Plotinus

262. Plotinus ſuppoſeth that the ſoul of the univerſe is not the original cauſe or author of the ſpecies, but receives them from intellect, the true principle of order and diſtinction, the ſource and giver of forms. Others conſider the vegetative ſoul only as ſome lower faculty of a higher ſoul, which animates the fiery ætherial ſpirit *. As for the blots and defects which appear in the courſe of this world, which ſome have thought to proceed from a fatality or neceſſity in nature, and others from an evil principle, that ſame philoſopher obſerves, that it may be the governing reaſon produceth and ordaineth all thoſe things; and, not intending that all parts ſhould be equally good, maketh ſome worſe than others by deſign, as all parts in an animal are not eyes: and in a city comedy or picture all ranks, characters, and colours are not equal or alike; even ſo exceſſes, defects, and contrary qualities, conſpire to the beauty and harmony of the world.

263. It cannot be denied, that with reſpect to the univerſe of things, we in this mortal ſtate, are like men educated in Plato's cave, looking on ſhadows with our backs turned to the light. But though our light be dim, and our ſituation bad, yet if the beſt uſe be made of both, perhaps ſomething may be ſeen. Proclus, in his commentary on the theology of Plato, obſerves there are two ſorts of philoſophers. The one placed body firſt in the order of beings, and made the faculty of thinking depend thereupon, ſuppoſing that the principles of all things are corporeal: that body moſt really or principally exiſts, and all other things in a ſecondary ſenſe, and by virtue of that. Others, making all corporeal things to be dependent upon ſoul or mind, think this to exiſt in the firſt place and primary ſenſe, and the being of bodies to be altogether derived from, and preſuppoſe that of the mind.

* Sect. 178.

264. Senſe

264. Senſe and experience acquaint us, with the courſe and analogy of appearances or natural effects. Thought, reaſon, intellect, introduce us into the knowledge of their cauſes. Senſible appearances, though of a flowing unſtable and uncertain nature, yet having firſt occupied the mind, they do by an early prevention, render the after taſk of thought more difficult; and as they amuſe the eyes and ears, and are more ſuited to vulgar uſes and the mechanic arts of life, they eaſily obtain the preference, in the opinion of moſt men, to thoſe ſuperior principles, which are the later growth of the human mind arrived to maturity and perfection, but, not affecting the corporeal ſenſe, are thought to be ſo far deficient in point of ſolidity and reality, ſenſible and real to common apprehenſions being the ſame thing. Although it be certain, that the principles of ſcience are neither objects of ſenſe nor imagination; and that intellect and reaſon are alone the ſure guides to truth.

265. The ſucceſsful curioſity of the preſent age, in arts and experiments and new ſyſtems, is apt to elate men, and make them overlook the ancients. But notwithſtanding that the encouragement and purſe of princes, and the united endeavours of great ſocieties in theſe later ages, have extended experimental and mechanical knowledge very far, yet it muſt be owned, that the ancients too were not ignorant of many things *, as well in phyſics as metaphyſics, which perhaps are more generally, though not firſt known in theſe modern times.

266. The Pythagoreans and Platoniſts had a notion of the true ſyſtem of the world. They allowed of mechanical principles, but actuated by ſoul or mind: they diſtinguiſhed the primary qualities in bodies from the ſecondary, making the former to be phyſical cauſes, and they underſtood phyſical cauſes in a right ſenſe: they ſaw that a mind infinite in power, unextended, inviſible, immortal, governed, connected and

* Sect. 166, 167, 168, 241, 242, &c.

contained

contained all things: they ſaw there was no ſuch thing as real abſolute ſpace: that mind, ſoul or ſpirit, truly and really exiſts: that bodies exiſt only in a ſecondary and dependent ſenſe: that the ſoul is the place of forms: that the ſenſible qualities are to be regarded as acts only in the cauſe, and as paſſions in us: they accurately conſidered the differences of intellect, rational ſoul, and ſenſitive ſoul, with their diſtinct acts of intellection, reaſoning, and ſenſation, points wherein the Carteſians and their followers, who conſider ſenſation as a mode of thinking, ſeem to have failed. They knew there was a ſubtile æther pervading the whole maſs of corporeal beings, and which was itſelf actually moved and directed by a mind: and that phyſical cauſes were only inſtruments, or rather marks and ſigns.

267. Thoſe ancient philoſophers underſtood the generation of animals to conſiſt, in the unfolding and diſtending of the minute imperceptible parts of pre-exiſting animalcules, which paſſeth for a modern diſcovery: this they took for the work of nature, but nature animate and intelligent * they underſtood that all things were alive and in motion: they ſuppoſed a concord and diſcord, union and diſunion in particles ſome attracting, others repelling each other: and that thoſe attractions and repulſions, ſo various, regular, and uſeful, could not be accounted for, but by an intelligence preſiding and directing all particular motions, for the conſervation and benefit of the whole.

268. The Ægyptians, who imperſonated nature, had made her a diſtinct principle, and even deified her under the name of Iſis. But Oſiris was underſtood to be mind or reaſon, chief and ſovereign of all. Oſiris, if we may believe Plutarch, was the firſt, pure, unmixed and holy principle, not diſcernible by the lower faculties; a glimpſe whereof like lightening darting forth, irradiates the underſtanding; with regard to

* Sect. 172.

which

which Plutarch adds, that Plato and Ariſtotle termed one part of philoſophy ἐποπτικὸν: to wit, when having ſoared above common mixed objects, and got beyond the precincts of ſenſe and opinion, they arrive to contemplate the firſt and moſt ſimple being, free from all matter and compoſition. This is that ἐνεία ὄντως ὄντα of Plato which employeth mind alone; which alone governs the ſoul. And the ſoul is that which immediately informs and animates nature.

269. Although the Ægyptians did ſymbolically repreſent the ſupreme divinity ſitting on a lotus, and that geſture hath been interpreted to ſignify, the moſt holy and venerable being to be utterly at reſt repoſing within himſelf; yet, for any thing that appears, this geſture might denote dignity as well as repoſe. And it cannot be denied, that Jamblichus, ſo knowing in the Ægyptian notions, taught there was an intellect that proceeded to generation, drawing forth the latent powers into light in the formation of things. Nor was this to be underſtood of an external world, ſubſiſting in real abſolute ſpace; for it was a doctrine of thoſe ancient ſages, that ſoul was the place of forms, as may be ſeen in the twelfth book of the arcane part of divine wiſdom, according to the Ægyptians. This notion was embraced by divers philoſophers of Greece, who may be ſuppoſed to have derived it from the ſame ſource, from whence many of their other opinions were drawn.

270. The doctrine of real abſolute external ſpace, induced ſome modern philoſophers to conclude it was a part or attribute of God, or that God himſelf was ſpace; inaſmuch as incommunicable attributes of the deity appeared to agree thereto, ſuch as infinity, immutability, indiviſibility, incorporeity, being uncreated, impaſſive, without beginning or ending; not conſidering that all theſe negative properties may belong to nothing. For nothing hath no limits, cannot be moved or changed, or divided, is neither created nor deſtroyed. A different way of thinking

appears in the Hermaic as well as other writings of the ancients. With regard to abſolute ſpace, it is obſerved in the Aſclepian dialogue; that the word ſpace or place hath by itſelf no meaning; and again, that it is impoſſible to underſtand what ſpace alone or pure ſpace is. And Plotinus acknowledgeth no place but ſoul or mind, expreſly affirming that the ſoul is not in the world, but the world in the ſoul. And farther, the place of the ſoul, ſaith he, is not body, but ſoul is in mind, and body in ſoul. See the third chapter of the fifth book of the fifth Æneid.

271. Concerning abſolute ſpace, that phantom of the mechanic geometrical philoſophers *, it may ſuffice to obſerve, that it is neither perceived by any ſenſe, nor proved by any reaſon, and was accordingly treated by the greateſt of the ancients as a thing merely viſionary. From the notion of abſolute ſpace ſprings that of abſolute motion †; and in theſe are ultimately founded the notions of external exiſtence, independence, neceſſity, and fate. Which fate, the idol of many moderns, was by old philoſophers differently underſtood, and in ſuch a ſenſe as not to deſtroy the αὐτεξούσιον of God or man. Parmenides, who thought all things to be made by neceſſity or fate, underſtood juſtice and providence to be the ſame with fate; which, how fixed and cogent ſoever with reſpect to man, may yet be voluntary with reſpect to God. Empedocles declared fate to be a cauſe uſing principles and elements. Heraclitus taught that fate was the general reaſon that runs through the whole nature of the

* Sect. 250.

† Our judgment in theſe matters is not to be overborn by a preſumed evidence of mathematical notions and reaſonings, ſince it is plain, the mathematicians of this age embrace obſcure notions, and uncertain opinions, and are puzzled about them, contradicting each other and diſputing like other men: witneſs their doctrine of fluxions, about which within theſe ten years I have ſeen publiſhed above twenty tracts and diſſertations, whoſe authors being utterly at variance, and inconſiſtent with each other, inſtruct byſtanders what to think of their pretenſions to evidence.

univerſe:

univerſe: which nature he ſuppoſed to be an ætherial body, the ſeed of the generation of all things. Plato held fate to be the eternal reaſon or law of nature. Chryſippus ſuppoſed that fate was a ſpiritual power which diſpoſed the world in order; that it was the reaſon and law of thoſe things which are adminiſtered by providence.

272. All the foregoing notions of fate, as repreſented by Plutarch, do plainly ſhew that thoſe ancient philoſophers did not mean by fate, a blind, head-long, unintelligent principle, but an orderly ſettled courſe of things conducted by a wiſe and provident mind. And as for the Ægyptian doctrine, it is indeed aſſerted in the Pimander, that all things are produced by fate. But Jamblichus, who drew his notions from Ægyyt, affirms that the whole of things is not bound up in fate; but that there is a principle of the ſoul higher than nature, whereby we may be raiſed to an union with the Gods and exempt ourſelves from fate. And in the Aſclepian dialogue it is expreſly ſaid that fate follows the decrees of God. And indeed, as all the motions in nature are evidently the product of reaſon *, it ſhould ſeem there is no room for neceſſity, in any other ſenſe than that of a ſteady regular courſe.

273. Blind fate and blind chance are at bottom much the ſame thing, and one no more intelligible than the other. Such is the mutual relation, connection, motion, and ſympathy of the parts of this world, that they ſeem as it were animated and held together by one ſoul: and ſuch is their harmony, order, and regular courſe, as ſheweth the ſoul to be governed and directed by a mind. It was an opinion of remote antiquity that the world was an animal †. If we may truſt the Hermaic writings, the Ægyptians thought all things did partake of life. This opinion was alſo ſo general and current among the Greeks, that Plutarch aſſerts all others held the world to be an animal, and governed by providence, ex-

* Sect. 154. † Sect. 153, 172.

cept Leucippus, Democritus, and Epicurus. And although an animal, containing all bodies within itſelf, could not be touched or ſenſibly affected from without; yet it is plain they attributed to it an inward ſenſe and feeling, as well as appetites and averſions; and that from all the various tones, actions and paſſions of the univerſe, they ſuppoſed one ſymphony, one animal act and life to reſult.

274. Jamblicus declares the world to be one animal, in which the parts however diſtant from each other, are nevertheleſs related and connected by one common nature. And he teacheth, what is alſo a received notion of the Pythagoreans and Platonics that there is no chaſm in nature, but a chain or ſcale of beings riſing by gentle uninterrupted gradations from the loweſt to the higheſt, each nature being informed and perfected by the participation of a higher. As air becomes igneous, ſo the pureſt fire becomes animal, and the animal ſoul becomes intellectual, which is to be underſtood not of the change of one nature into another, but of the connection of different natures, each lower nature being, according to thoſe philoſophers, as it were a receptacle or ſubject for the next above it to reſide and act in.

275. It is alſo the doctrine of Platonic philoſophers, that intellect is the very life of living things, the firſt principle and exemplar of all, from whence by different degrees are derived the inferior claſſes of life; firſt the rational, then the ſenſitive, after that the vegetal, but ſo as in the rational animal there is ſtill ſomewhat intellectual, again in the ſenſitive there is ſomewhat rational, and in the vegetal ſomewhat ſenſitive, and laſtly in mixt bodies as metals and minerals, ſomewhat of vegetation. By which means the whole is thought to be more perfectly connected. Which doctrine implies that all the faculties, inſtincts, and motions of inferior beings, in their ſeveral reſpective ſubordinations, are derived from and depend upon mind and intellect.

276. Both

276. Both Stoics and Platonics held the world to be alive, though ſometimes it be mentioned as a ſentient animal, ſometimes as a plant or vegetable. But in this, notwithſtanding what hath been ſurmiſed by ſome learned men, there ſeems to be no atheiſm. For ſo long as the world is ſuppoſed to be quickened by elementary fire or ſpirit, which is itſelf animated by ſoul, and directed by underſtanding, it follows that all parts thereof originally depend upon, and may be reduced unto, the ſame indiviſible ſtem or principle, to wit, a ſupreme mind; which is the concurrent doctrine of Pythagoræans, Platonics, and Stoics.

277. There is, according to thoſe philoſophers, a life infuſed throughout all things: the πῦρ νοερὸν, πῦρ τεχνικὸν an intellectual and artificial fire *, an inward principle, animal ſpirit, or natural life producing and forming within as art doth without, regulating, moderating, and reconciling the various motions, qualities and parts of this mundane ſyſtem. By virtue of this life the great maſſes are held together in their ordinary courſes, as well as the minuteſt particles governed in their natural motions, according to the ſeveral laws of attraction, gravity, electricity, magnetiſm, and the reſt. It is this gives inſtincts, teaches the ſpider her web, and the bee her honey. This it is that directs the roots of plants to draw forth juices from the earth, and the leaves and corticle veſſels to ſeparate and attract ſuch particles of air, and elementary fire, as ſuit their reſpective natures.

278. Nature ſeems to be not otherwiſe diſtinguiſhed from the *anima mundi*, than as life is from ſoul, and upon the principles of the oldeſt philoſophers, may not improperly or incongruouſly be ſtyled the life of the world. Some Platonics indeed, regard life as the act of nature, in like manner as intellection is of the mind or intellect. As the firſt intellect acts by underſtanding, ſo nature according to them acts or generates

* Sect. 166, 168, 174, 175, &c.

by

by living. But life is the act of the ſoul, and ſeems to be very nature itſelf, which is not the principle, but the reſult of another and higher principle, being a life reſulting from ſoul, as cogitation from intellect.

279. If nature be ſuppoſed the life of the world, animated by one ſoul, compacted into one frame, and directed or governed in all parts by one mind; this ſyſtem cannot be accuſed of atheiſm; though perhaps it may of miſtake or impropriety. And yet as one preſiding mind gives unity to the infinite aggregate of things, by a mutual communion of actions and paſſions, and an adjuſtment of parts, cauſing all to concur in one view to one and the ſame end, the ultimate and ſupreme good of the whole, it ſhould ſeem reaſonable to ſay, with Ocellus Lucanus the Pythagorean, that as life holds together the bodies of animals, the cauſe whereof is the ſoul; and as a city is held together by concord, the cauſe whereof is law; even ſo the world is held together by harmony, the cauſe whereof is God. And in this ſenſe, the world or univerſe may be conſidered either as one animal * or one city.

280. Ariſtotle diſapproves the opinion of thoſe who hold a ſoul to be diffuſed throughout the world; and for this reaſon; becauſe the elements are not alive. Though perhaps it may not be eaſy to prove, that blood and animal ſpirit are more alive in man, than water and fire in the world. That philoſopher, in his books of the ſoul, remarks upon an opinion ſet forth in the Orphics, of the ſoul's entering from the univerſe into living creatures being borne by winds, that this cannot be true of plants or of certain animals which do not breathe. But air veſſels are by later experiments allowed to be found in all plants and animals. And air may in ſome ſort not improperly be ſaid, to be the carrier or vehicle of the ſoul, inaſmuch as it is the vehicle of fire, which is the ſpirit immediately moved and animated by the ſoul †.

* Sect. 172, 277. † Sect. 163, 171.

281. The

281. The living fire, the living omniform ſeminary of the world, and other expreſſions of the like nature occurring in the ancient and Platonic philoſophy, how can they be underſtood excluſive of light or elemental fire, the particles of which are known to be heterogeneous, and, for ought we know, may ſome of them be organized, and, notwithſtanding their wonderful minuteneſs, contain original ſeeds which, being formed and ſowed in a proper matrix, do gradually unfold and manifeſt themſelves, ſtill growing to a juſt proportion of the ſpecies.

282. May not this æthereal ſeminary conſiſtently with the notions of that philoſophy, which aſcribed much of generation to celeſtial influence, be ſuppoſed to impregnate plants and animals with the firſt principles, the ſtamina, or thoſe animalcules which Plato, in his Timæus, ſaith are inviſible for their ſmallneſs, but, being ſown in a proper matrix, are therein gradually diſtended and explicated by nouriſhment, and at length the animals brought forth to light. Which notion hath been revived and received of late years by many, who perhaps are not aware of its antiquity, or that it was to be found in Plato. Timæus Locrenſis, in his book of the ſoul of the world, ſuppoſeth even ſouls to be derived from the celeſtial luminaries, excepting only the rational or intellectual part. But what influence or influx is there from the celeſtial bodies, which hath not light for its vehicle * ?

283. What other nature there ſhould be intermediate between the ſoul of the world † and this groſs corporeal ſyſtem, which might be the vehicle of life, or, to uſe the language of philoſophers, might receive or be impreſſed with the forms of things, is difficult to comprehend. It is a vulgar remark, that the works of art do not bear a nice microſcopial inſpection, but the more helps are uſed, and the more nicely you pry into natural productions, the more do you diſcover of the fine mechaniſm

* Sect. 43. † Sect. 171.

of

of nature, which is endleſs or inexhauſtible; new and other parts, more ſubtile and delicate than the precedent, ſtill continuing to offer themſelves to view. And theſe microſcopial obſervations have confirmed the ancient theory concerning generation, delivered in the Timæus of Plato. But that theory or hypotheſis, how agreeable ſoever to modern diſcoveries, is not alone ſufficient to explain the phænomena, without the immediate action of a mind. And Ficinus, notwithſtanding what he himſelf and other Platonics ſay of a plaſtic nature, is obliged to own, that with the mundane force or ſoul it is to be underſtood, there is joined an intelligence, upon which the ſeminal nature conſtantly depends, and by which it is governed.

284. Alcinous in his tract of the doctrine of Plato ſaith that God hath given the world both mind and ſoul: others include both in the word ſoul, and ſuppoſe the ſoul of the world to be God. Philo appears to be of this opinion in ſeveral parts of his writings. And Virgil, who was no ſtranger to the Pythagorean and Platonic tenets writes to the ſame purpoſe.

Deum namque ire per omnes
Terras que tractuſque maris cœlumque profundum.
Hinc pecudes armenta, viros, genus omne ferarum
Quemque ſibi tenues naſcentem arceſſere vitas.

Thus much the ſchools of Plato and Pythagoras ſeem agreed in, to wit, that the ſoul of the world *, whether having a diſtinct mind of its own, or directed by a ſuperior mind †, doth embrace all its parts, connect them by an inviſible and indiſſoluble chain, and preſerve them ever well adjuſted and in good order.

* Sect. 153, 172. † Sect. 145, 279.

285. Natu-

285. Naturaliſts, whoſe proper province it is to conſider phænomena, experiments, mechanical organs and motions, principally regard the viſible frame of things or corporeal world, ſuppoſing ſoul to be contained in body. And this hypotheſis may be tolerated in phyſics, as it is not neceſſary in the art of dyalling or navigation to mention the true ſyſtem or earth's motion. But thoſe who, not content with ſenſible appearances, would penetrate into the real and true cauſes (the object of theology, metaphyſics, or the *philoſophia prima*) will rectify this error, and ſpeak of the world as contained by the ſoul, and not the ſoul by the world.

286. Ariſtotle hath obſerved there were indeed ſome who thought ſo groſly, as to ſuppoſe the univerſe to be one only corporeal and extended nature: but in the firſt book of his metaphyſics he juſtly remarks they were guilty of a great miſtake; foraſmuch as they took into their account the elements of corporeal beings alone; whereas there are incorporeal beings alſo in the univerſe; and while they attempt to aſſign the cauſes of generation and corruption, and account for the nature of all things, they did at the ſame time deſtroy the very cauſe of motion.

287. It is a doctrine among other ſpeculations contained in the Hermaic writings, that all things are one. And it is not improbable that Orpheus, Parmenides, and others among the Greeks, might have derived their notion of τὸ ἓν THE ONE from Ægypt. Though that ſubtile metaphyſician Parmenides, in his doctrine of ἓν ὄντως ſeems to have added ſomething of his own. If we ſuppoſe, that one and the ſame mind is the univerſal principle of order and harmony throughout the world, containing and connecting all its parts, and giving unity to the ſyſtem, there ſeems to be nothing atheiſtical or impious in this ſuppoſition.

288. Number is no object of ſenſe: it is an act of the mind. The ſame thing in a different conception is one or many. Comprehending

God and the creatures in one general notion, we may ſay that all things together make one univerſe, or τὸ πᾶν. But if we ſhould ſay, that all things make one God; this would, indeed, be an erroneous notion of God, but would not amount to atheiſm, ſo long as mind or intellect was admitted to be the τὸ ἡγεμονικὸν, the governing part. It is nevertheleſs more reſpectful, and conſequently the truer notion of God, to ſuppoſe him neither made up of parts, nor to be himſelf a part of any whole whatſoever.

289. All thoſe, who conceived the univerſe to be an animal, muſt in conſequence of that notion, ſuppoſe all things to be one. But to conceive God to be the ſentient ſoul of an animal, is altogether unworthy and abſurd. There is no ſenſe, nor ſenſory, nor any thing like a ſenſe or ſenſory in God. Senſe implies an impreſſion from ſome other being, and denotes a dependence in the ſoul which hath it. Senſe is a paſſion: and paſſions imply imperfection. God knoweth all things, as pure mind or intellect, but nothing by ſenſe, nor in nor through a ſenſory. Therefore to ſuppoſe a ſenſory of any kind, whether ſpace or any other in God would be very wrong, and lead us into falſe conceptions of his nature. The preſuming there was ſuch a thing as real abſolute uncreated ſpace, ſeems to have occaſioned that modern miſtake. But this preſumption was without grounds.

290. Body is oppoſite to ſpirit or mind. We have a notion of ſpirit from thought and action. We have a notion of body from reſiſtance. So far forth as there is real power, there is ſpirit. So far forth as there is reſiſtance, there is inability or want of power: that is, there is a negation of ſpirit. We are embodied, that is, we are clogged by weight, and hindered by reſiſtance. But in reſpect of a perfect ſpirit, there is nothing hard or impenetrable: there is no reſiſtance to the deity: nor hath he any body: nor is the ſupreme being united to the world, as the ſoul

ſoul of an animal is to its body, which neceſſarily implieth defect, both as an inſtrument and as a conſtant weight and impediment.

291. Thus much it conſiſts with piety to ſay, that a divine agent doth by his virtue permeate and govern the elementary fire or light * which ſerves as animal ſpirit to enliven and actuate the whole maſs, and all the members of this viſible world. Nor is this doctrine leſs philoſophical than pious. We ſee all nature alive or in motion. We ſee water turned into air, and air rarefied and made elaſtic † by the attraction of another medium, more pure indeed, more ſubtile and more volatile than air. But ſtill, as this is a moveable extended, and conſequently, a corporeal being, ‡ it cannot be itſelf the principal of motion, but leads us naturally and neceſſarily to an incorporeal ſpirit or agent. We are conſcious that a ſpirit can begin, alter, or determinate motion, but nothing of this appears in body. Nay, the contrary is evident, both to experiment and reflection.

292. Natural phænomena are only natural appearances. They are, therefore, ſuch as we ſee and perceive them. Their real and objective natures are, therefore, the ſame; paſſive without any thing active, fluent and changing without any thing permanent in them. However, as theſe make the firſt impreſſions, and the mind takes her firſt flight and ſpring, as it were, by reſting her foot on theſe objects, they are not only firſt conſidered by all men, but moſt conſidered by moſt men. They and the phantoms that reſult from thoſe appearances, the children of imagination grafted upon ſenſe, ſuch for example as pure ſpace § are thought by many the very firſt in exiſtence and ſtability, and to embrace and comprehend all other beings.

* Sect. 157, 172. † Sect. 149, 152, 200. ‡ Sect. 207. § Sect. 270.

293. Now although ſuch phantoms as corporeal forces, abſolute motions, and real ſpaces, do paſs in phyſics for cauſes and principles*, yet are they in truth but hypotheſes, nor can they be the objects of real ſcience. They paſs nevertheleſs in phyſics converſant about things of ſenſe, and confined to experiments and mechanics. But when we enter the province of the *philoſophia prima*, we diſcover another order of beings, mind and its acts, permanent being, not dependent on corporeal things, nor reſulting, nor connected, nor contained; but containing, connecting, enlivening the whole frame; and imparting thoſe motions, forms, qualities, and that order and ſymmetry to all thoſe tranſient phænomena, which we term the courſe of nature.

294. It is with our faculties as with our affections: what firſt ſeizes holds faſt†. It is a vulgar theme, that man is a compound of contrarieties, which breed a reſtleſs ſtruggle in his nature, between fleſh and ſpirit, the beaſt and the angel, earth and heaven, ever weighed down and ever bearing up. During which conflict the character fluctuates: when either ſide prevails, it is then fixed for vice or virtue. And life from different principles takes a different iſſue. It is the ſame in regard to our faculties. Senſe at firſt beſets and overbears the mind. The ſenſible appearances are all in all: our reaſonings are employed about them: our deſires terminate in them: we look no farther for realities or cauſes; till intellect begins to dawn, and caſt a ray on this ſhadowy ſcene. We then perceive the true principle of unity, identity, and exiſtence. Thoſe things that before ſeemed to conſtitute the whole of being, upon taking an intellectual view of things, prove to be but fleeting phantoms.

295. From the outward form of groſs maſſes which occupy the vulgar, a curious enquirer proceeds to examine the inward ſtructure and

* Sect. 220, 249, 250. † Sect. 264.

minute

minute parts, and from obſerving the motions in nature, to diſcover the laws of thoſe motions. By the way, he frames his hypotheſis and ſuits his language to this natural philoſophy. And theſe fit the occaſion and anſwer the end of a maker of experiments or mechanic, who means only to apply the powers of nature, and reduce the phænomena to rules. But, if proceeding ſtill in his analyſis and inquiry, he aſcends from the ſenſible into the intellectual world, and beholds things in a new light and a new order. He will then change his ſyſtem, and perceive that what he took for ſubſtances and cauſes are but fleeting ſhadows: that the mind contains all, and acts all, and is to all created beings the ſource of unity and identity, harmony and order, exiſtence and ſtability.

296. It is neither acid, nor ſalt, nor ſulphur, nor air, nor æther, nor viſible corporeal fire *, much leſs the phantom, fate, or neceſſity, that is the real agent, but by a certain analyſis, a regular connexion and climax, we aſcend through all thoſe mediums to a glimpſe of the firſt mover, inviſible, incorporeal, unextended, intellectual ſource of life and being. There is, it muſt be owned, a mixture of obſcurity and prejudice in human ſpeech and reaſonings. This is unavoidable, ſince the veils of prejudice and error are ſlowly and ſingly taken off one by one. But if there are many links in the chain which connects the two extremes of what is groſly ſenſible and purely intelligible, and it ſeem a tedious work, by the ſlow helps of memory, imagination, and reaſon, oppreſſed and overwhelmed, as we are, by the ſenſes, through erroneous principles and long ambages of words and notions, to ſtruggle upwards into the light of truth, yet as this gradually dawns, further diſcoveries ſtill correct the ſtyle and clear up the notions.

297. The mind, her acts, and faculties, furniſh a new and diſtinct claſs of objects †, from the contemplation whereof ariſe certain other notions,

* Sect. 155. † Sect. 163, 266.

principles,

principles, and verities, ſo remote from, and even ſo repugnant to, the firſt prejudices which ſurpriſe the ſenſe of mankind, that they may well be excluded from vulgar ſpeech and books, as abſtract from ſenſible matters, and more fit for the ſpeculation of truth, the labour and aim of a few, than for the practice of the world, or the ſubjects of experimental or mechanical inquiry. Nevertheleſs though, perhaps, it may not be reliſhed by ſome modern readers, yet the treating in phyſical books concerning metaphyſical and divine matters can be juſtified by great authorities among the ancients: not to mention, that he, who profeſſedly delivers the elements of a ſcience, is more obliged to method and ſyſtem, and tied down to more rigorous laws, than a mere eſſay writer. It may, therefore, be pardoned if this rude eſſay doth, by inſenſible tranſitions, draw the reader into remote inquiries and ſpeculations, that were not, perhaps, thought of, either by him or by the author, at firſt ſetting out.

298. There are traces of profound thought as well as primeval tradition in the Platonic, Pythagorean, Ægyptian, and Chaldaic philoſophy *. Men in thoſe early days were not overlaid with languages and literature. Their minds ſeem to have been more exerciſed, and leſs burdened, than in later ages; and, as ſo much nearer the beginning of the world, to have had the advantage of patriarchal lights handed down through a few hands. It cannot indeed be affirmed (how probable ſoever it may ſeem) that Moſes was that ſame Mochus, with whoſe ſucceſſors, prieſts and prophets, Pythagoras is ſaid to have converſed at Sidon. Yet the ſtudy of philoſophy appears to be of very great antiquity and remote original; inaſmuch as Timæus Locrenſis, that ancient Pythagorean, author of the book concerning the ſoul of the world, ſpeaks of a moſt ancient philoſophy, even in his time, ἀ πρεσβύτα φιλοσοφία, ſtirring up and recovering the ſoul from a ſtate of ignorance to the contemplation of divine things.

* Sect. 179, 266.

And

And though the books attributed to Mercurius Triſmegiſtus were none of them wrote by him, and are allowed to contain ſome manifeſt forgeries: yet it is alſo allowed, that they contain tenets of the ancient Ægyptian philoſophy, though dreſſed perhaps in a more modern garb. To account for which, Jamblichus obſerves, that the books under his name contain indeed mercurial opinions, though often expreſſed in the ſtyle of the Greek philoſophers; as having been tranſlated from the Ægyptian tongue into Greek.

299. The difference of Iſis from Oſiris * reſembles that of the moon from the ſun, of the female from the male, of *natura naturata* (as the ſchoolmen ſpeak) from *natura naturans*. But Iſis, though moſtly taken for nature, yet (as the Pagan divinities were very fluctuating things) it ſometimes ſignified τὸ πᾶν. And we find in Mountfaucon an Iſis of the ordinary form with this inſcription θεᾶ παντός. And in the menſa Iſiaca, which ſeems to exhibit a general ſyſtem of the religion and ſuperſtition of the Ægyptians, Iſis on her throne poſſeſſeth the center of the table. Which may ſeem to ſignify, that the univerſe or τὸ πᾶν was the center of the ancient ſecret religion of the Ægyptians; their Iſis or τὸ πᾶν comprehending both Oſiris the author of nature and his work.

300. Plato and Ariſtotle conſidered God as abſtracted or diſtinct from the natural world. But the Ægyptians conſidered God and nature as making one whole, or all things together as making one univerſe. In doing which they did not exclude the intelligent mind, but conſidered it as containing all things. Therefore, whatever was wrong in their way of thinking, it doth not, nevertheleſs, imply or lead to atheiſm.

301. The human mind is ſo much clogged and borne downward, by the ſtrong and early impreſſions of ſenſe †, that it is wonderful, how the

* Sect. 268. † Sect. 264.

ancients

ancients ſhould have made even ſuch a progreſs, and ſeen ſo far into intellectual matters, without ſome glimmering of a divine tradition. Whoever conſiders a parcel of rude ſavages left to themſelves, how they are ſunk and ſwallowed up in ſenſe and prejudice, and how unqualified by their natural force to emerge from this ſtate, will be apt to think that the firſt ſpark of philoſophy was derived from heaven; and that it was (as a heathen writer expreſſeth it) θεοπαράδοτος φιλοσοφία.

302. The lapſed ſtate of human kind is a thing to which the ancient philoſophers were not ſtrangers. The λύσις, the φύγη, the παλιγγενεσία ſhew that the Ægyptians and Pythagoreans, the Platoniſts and Stoics, had all ſome notion of this doctrine, the outlines of which ſeem to have been ſketched out in thoſe tenets. Theology and philoſophy gently unbind the ligaments, that chain the ſoul down to the earth, and aſſiſt her flight towards the ſovereign good. There is an inſtinct or tendency of the mind upwards, which ſheweth a natural endeavour to recover and raiſe ourſelves, from our preſent ſenſual and low condition, into a ſtate of light, order, and purity.

303. The perceptions of ſenſe are groſs: but even in the ſenſes there is a difference. Though harmony and proportion are not objects of ſenſe, yet the eye and the ear are organs, which offer to the mind ſuch materials, by means whereof ſhe may apprehend both the one and the other. By experiments of ſenſe we become acquainted with the lower faculties of the ſoul; and from them, whether by a gradual * evolution, or aſcent, we arrive at the higheſt. Senſe ſupplies images to memory. Theſe become ſubjects for fancy to work upon. Reaſon conſiders and judges of the imaginations. And theſe acts of reaſon become new objects to the underſtanding. In this ſcale, each lower faculty is a ſtep that leads to one above it. And the uppermoſt naturally leads to the deity, which is

* Sect. 275.

rather

rather the object of intellectual knowledge than even of the diſcurſive faculty, not to mention the ſenſitive. There runs a chain throughout the whole ſyſtem of beings. In this chain one link drags another. The meaneſt things are connected with the higheſt. The calamity therefore is neither ſtrange nor much to be complained of, if a low ſenſual reader ſhall, from mere love of the animal life, find himſelf drawn on, ſurpriſed, and betrayed into ſome curioſity concerning the intellectual.

304. There is, according to Plato, properly no knowledge, but only opinion concerning things ſenſible and periſhing *, not becauſe they are naturally abſtruſe and involved in darkneſs: but becauſe their nature and exiſtence is uncertain, ever fleeting and changing. Or rather, becauſe they do not in ſtrict truth exiſt at all, being always generating or *in fieri*, that is, in a perpetual flux, without any thing ſtable or permanent in them to conſtitute an object of real ſcience. The Pythagoreans and Platonics diſtinguiſh between τὸ γινόμενον and τὸ ὄν that which is ever generated and that which exiſts. Senſible things and corporeal forms are perpetually producing and periſhing, appearing and diſappearing, never reſting in one ſtate, but always in motion and change; and therefore in effect, not one being but a ſucceſſion of beings: while τὸ ὄν is underſtood to be ſomewhat of an abſtract or ſpiritual nature, and the proper object of intellectual knowledge. Therefore as there can be no knowledge of things flowing and inſtable, the opinion of Protagoras and Theætetus, that ſenſe was ſcience, is abſurd. And indeed nothing is more evident, than that the apparent ſizes and ſhapes, for inſtance, of things are in a conſtant flux, ever differing as they are viewed at different diſtances, or with glaſſes more or leſs accurate. As for thoſe abſolute magnitudes and figures, which certain Carteſians and other moderns ſuppoſe to be in things; that muſt ſeem a vain ſuppoſition, to whoever conſiders, it is ſupported by no argument of reaſon, and no experiment of ſenſe.

* Sect. 262, 264.

305. As underſtanding perceiveth not, that is, doth not hear or ſee or feel, ſo ſenſe knoweth not: and although the mind may uſe both ſenſe and fancy, as means whereby to arrive at knowledge, yet ſenſe or ſoul, ſo far forth as ſenſitive, knoweth nothing. For, as it is rightly obſerved in the Theætetus of Plato, ſcience conſiſts not in the paſſive perceptions, but in the reaſoning upon them, τῷ περὶ ἐκείνων συλλογισμῳ.

306. In the ancient philoſophy of Plato and Pythagoras, we find diſtinguiſhed three ſorts of objects: in the firſt place a form or ſpecies that is neither generated nor deſtroyed, unchangeable, inviſible, and altogether imperceptible to ſenſe, being only underſtood by the intellect. A ſecond ſort there is ever fluent and changing *, generating and periſhing, appearing and vaniſhing. This is comprehended by ſenſe and opinion. The third kind is matter which, as Plato teacheth, being neither an object of underſtanding nor of ſenſe, is hardly to be made out by a certain ſpurious way of reaſoning λογισμῷ τινι νόθῳ μόγις πιστόν. See his Timæus. The ſame doctrine is contained in the Pythagoric treatiſe *de anima mundi*, which diſtinguiſhing ideas, ſenſible things, and matter, maketh the firſt to be apprehended by intellect, the ſecond by ſenſe, and the laſt, to wit, matter, λογισμῷ νόθῳ. Whereof Themiſtius the Peripatetic aſſigns the reaſon. For, ſaith he, that act is to be eſteemed ſpurious, whoſe object hath nothing poſitive, being only a mere privation, as ſilence or darkneſs. And ſuch he accounteth matter.

307. Ariſtotle maketh a threefold diſtinction of objects according to the three ſpeculative ſciences. Phyſics he ſuppoſeth to be converſant about ſuch things as have a principle of motion in themſelves, mathematics about things permanent but not abſtracted, and theology about being abſtracted and immoveable, which diſtinction may be ſeen in the ninth

* Sect. 292, 293.

book

book of his metaphyſics. Where by abſtracted, χωριστὸν, he underſtands ſeparable from corporeal beings and ſenſible qualities.

308. That philoſopher held that the mind of man was a *tabula raſa*, and that there were no innate ideas. Plato on the contrary, held original ideas in the mind, that is, notions which never were or can be in the ſenſe, ſuch as being, beauty, goodneſs, likeneſs, parity. Some perhaps may think the truth to be this: that there are properly no ideas or paſſive objects in the mind, but what were derived from ſenſe: but that there are alſo beſides theſe her own acts or operations: ſuch are notions.

309. It is a maxim of the Platonic philoſophy, that the ſoul of man was originally furniſhed with native inbred notions, and ſtands in need of ſenſible occaſions, not abſolutely for producing them, but only for awakening, rouſing or exciting, into act what was already preexiſtent, dormant, and latent in the ſoul; as things are ſaid to be laid up in the memory, though not actually perceived, until they happen to be called forth and brought into view by other objects. This notion ſeemeth ſomewhat different from that of innate ideas, as underſtood by thoſe moderns who have attempted to explode them. To underſtand and to be, are according to Parmenides the ſame thing. And Plato in his ſeventh letter makes no difference between νοῦς and ἐπιστήμη, mind and knowledge. Whence it follows that mind, knowledge, and notions, either in habit or in act, always go together.

310. And albeit Ariſtotle conſidered the ſoul in its original ſtate as a blank paper, yet he held it to be the proper place of forms. τὴν ψυχὴν εἶναι τόπον εἰδῶν *. Which doctrine firſt maintained by others he admits, under this reſtriction, that it is not to be underſtood of the whole ſoul but only of the νοητικὴ; as is to be ſeen in his third book *de anima*. Whence, according to Themiſtius in his commentary on that treatiſe, it may be inferred

* Sect. 269.

ferred that all beings are in the ſoul. For, ſaith he, the forms are the beings. By the form every thing is what it is. And he adds, it is the ſoul that imparteth forms to matter; τὴν ὕλην μορφῶσα ποικίλαις μόρφαις. Therefore they are firſt in the ſoul. He farther adds, that the mind is all things, taking the forms of all things it becomes all things by intellect and ſenſe. Alexander Aphrodiſæus ſaith as much, affirming the mind to be all things κατὰ τε τὸ νοειν καὶ τὸ αισθάνεσθαι. And this in fact is Ariſtotle's own doctrine in his third book *de anima*, where he alſo aſſerts, with Plato, that actual knowledge and the thing known are all one. τὸ ἀυτὸ δὲ ἐστὶν ἡ κατ' ἐνέργειαν ἐπιστήμη τῷ πράγματι. Whence it follows that the things are where the knowledge is, that is to ſay, in the mind. Or, as it is otherwiſe expreſſed, that the ſoul is all things. More might be ſaid to explain Ariſtotle's notion, but it would lead too far.

311. As to an abſolute actual exiſtence * of ſenſible or corporeal things, it doth not ſeem to have been admitted either by Plato or Ariſtotle. In the Theætetus we are told, that if any one ſaith a thing is or is made, he muſt withal ſay, for what, or of what, or in reſpect of what, it is or is made; for, that any thing ſhould exiſt in itſelf or abſolutely is abſurd. Agreeably to which doctrine it is alſo farther affirmed by Plato, that it is impoſſible a thing ſhould be ſweet and ſweet to nobody. It muſt nevertheleſs be owned with regard to Ariſtotle, that even in his metaphyſics there are ſome expreſſions which ſeem to favour the abſolute exiſtence of corporeal things. For inſtance, in the eleventh book, ſpeaking of corporeal ſenſible things, what wonder, ſaith he, if they never appear to us the ſame, no more than to ſick men, ſince we are always changing and never remain the ſame ourſelves? and again, he ſaith, ſenſible things, although they receive no change in themſelves, do nevertheleſs in ſick perſons produce different ſenſations and not the ſame.

* Sect. 264, 292, 294.

Theſe

Theſe paſſages would ſeem to imply a diſtinct and abſolute exiſtence of the objects of ſenſe.

312. But it muſt be obſerved, that Ariſtotle diſtinguiſheth a twofold exiſtence potential and actual. It will not, therefore, follow that, according to Ariſtotle, becauſe a thing is, it muſt actually exiſt. This is evident from the eighth book of his metaphyſics, where he animadverts on the Megaric philoſophers, as not admitting a poſſible exiſtence diſtinct from the actual: from whence, ſaith he, it muſt follow, that there is nothing cold or hot or ſweet or any ſenſible thing at all, where there is no perception. He adds, that in conſequence of that Megaric doctrine, we can have no ſenſe but while we actually exert it: we are blind when we do not ſee, and therefore both blind and deaf ſeveral times in a day.

313. The ἐντελέχειαι πρῶται of the Peripatetics, that is, the ſciences, arts and habits, were by them diſtinguiſhed from the acts or ἐντελέχειαι δεύτεραι, and ſuppoſed to exiſt in the mind, though not exerted or put into act. This ſeems to illuſtrate the manner in which Socrates, Plato, and their followers conceive innate * notions to be in the ſoul of man. It was the Platonic doctrine, that human ſouls or minds deſcended from above, and were ſowed in generation, that they were ſtunned, ſtupified, and intoxicated by this deſcent and immerſion into animal nature. And that the ſoul, in this ὑπνώσεις or ſlumber, forgets her original notions, which are ſmothered and oppreſſed by many falſe tenets and prejudices of ſenſe. Inſomuch that Proclus compares the ſoul, in her deſcent inveſted with growing prejudices, to Glaucus diving to the bottom of the ſea, and there contracting divers coats of ſea weed, coral, and ſhells, which ſtick cloſe to him and conceal his true ſhape.

* Sect. 309.

314. Hence,

314. Hence, according to this philoſophy, the mind of man is ſo reſtleſs to ſhake of that ſlumber, to diſengage and emancipate herſelf from thoſe prejudices and falſe opinions, that ſo ſtraitly beſet and cling to her, to rub off thoſe covers, that diſguiſe her original form, and to regain her primeval ſtate and firſt notions: hence that perpetual ſtruggle to recover the loſt region of light, that ardent thirſt and endeavour after truth and intellectual ideas, which ſhe would neither ſeek to attain, nor rejoice in, nor know when attained, except ſhe had ſome prenotion or anticipation of them, and they had lain innate and dormant like habits and ſciences in the mind, or things laid up, which are called out and rouſed by recollection or reminiſcence. So that learning ſeemeth in effect reminiſcence.

315. The Peripatetics themſelves diſtinguiſh between reminiſcence and mere memory. Themiſtius obſerves that commonly the beſt memories go with the worſt parts; but that reminiſcence is moſt perfect in the moſt ingenious minds. And notwithſtanding the *tabula raſa* * of Ariſtotle, yet ſome of his followers have undertaken to make him ſpeak Plato's ſenſe. Thus Plutarch the Peripatetic teacheth, as agreeable to his maſter's doctrine, that learning is reminiſcence, and that the νοῦς κατ' ἕξιν is in children. Simplicius alſo in his commentary on the third book of Ariſtotle περὶ ψυχῆς, ſpeaketh of a certain interior reaſon in the ſoul, acting of itſelf, and originally full of its own proper notions, πλήρης ἀφ' ἑαυτῆ τῶν οἰκείων γνωστῶν.

316. And, as the Platonic philoſophy ſuppoſed intellectual notions to be originally inexiſtent or innate in the ſoul † ſo likewiſe it ſuppoſed ſenſible qualities to exiſt (though not originally) in the ſoul, and there only. Socrates ſaith to Theætetus, you muſt not think the white colour that you ſee is in any thing without your eyes, or in your eyes, or in any place at all. And in the Timæus, Plato teacheth, that the figure and motion of

* Sect. 308. † Sect. 309, 314.

the

the particles of fire dividing the parts of our bodies produce that painful ſenſation we call heat. And Plotinus, in the ſixth book of his ſecond Æneid, obſerves that heat and other qualities are not qualities in the things themſelves, but acts: that heat is not a quality but act in the fire: that fire is not really what we perceive in the qualities light, heat and colour. From all which it is plain, that whatever real things they ſuppoſe to exiſt independent of the ſoul, thoſe were neither ſenſible things, nor cloathed with ſenſible qualities.

317. Neither Plato nor Ariſtotle by matter, ὕλη, underſtood corporeal ſubſtance, whatever the moderns may underſtand by that word. To them certainly it ſignified no poſitive actual being. Ariſtotle deſcribes it as made up of negatives, having neither quantity nor quality nor eſſence. And not only the Platoniſts and Pythagoreans, but alſo the Peripatetics themſelves declare it to be known, neither by ſenſe, nor by any direct and juſt reaſoning, but only by ſome ſpurious or adulterine method, as hath been obſerved before. Simon Portius, a famous Peripatetic of the ſixteenth century, denies it to be any ſubſtance at all, for, ſaith he, *nequit per ſe ſubſiſtere quia ſequeretur, id quod non eſt in actu eſſe in actu.* If Jamblichus may be credited, the Ægyptians ſuppoſed matter ſo far from including aught of ſubſtance or eſſence, that according to them, God produced it by a ſeparation from all ſubſtance, eſſence or being, ἀπὸ οὐσιότητος ἀποχωρίσεως ὑλότητος. That matter is actually nothing, but potentially all things, is the doctrine of Ariſtotle, Theophraſtus, and all the ancient Peripatetics.

318. According to thoſe philoſophers, matter is only a *pura potentia*, a mere poſſibility. But Anaximander, ſucceſſor to Thales, is repreſented as having thought the ſupreme deity to be infinite matter. Nevertheleſs though Plutarch calleth it matter, yet it was ſimply τὸ ἄπειρον, which means no more than infinite or indefinite. And although the moderns teach that

that ſpace is real and infinitely extended: yet if we conſider that it is no intellectual notion, nor yet perceived by any of our ſenſes, we ſhall perhaps be inclined to think with Plato in his Timæus, that this alſo is the reſult of λογισμὸς νόθος or ſpurious reaſoning, and a kind of waking dream. Plato obſerves that we dream, as it were, when we think of place, and believe it neceſſary, that whatever exiſts ſhould exiſt in ſome place. Which place or ſpace * he alſo obſerves is μετ' ἀναισθησίας ἅπτον, that is, to be felt as darkneſs is ſeen, or ſilence heard, being a mere privation.

319. If any one ſhould think to infer the reality or actual being of matter from the modern tenet, that gravity is always proportionable to the quantity of matter, let him but narrowly ſcan the modern demonſtration of that tenet, and he will find it to be a vain circle, concluding in truth no more than this, that gravity is proportionable to weight, that is to itſelf. Since matter is conceived only as defect and mere poſſibility; and ſince God is abſolute perfection and act; it follows there is the greateſt diſtance and oppoſition imaginable between God and matter. Inſomuch that a material God would be altogether inconſiſtent.

320. The force that produces, the intellect that orders, the goodneſs that perfects all things is the ſupreme being. Evil, defect, negation, is not the object of God's creative power. From motion the Peripatetics trace out a firſt immoveable mover. The Platonics make God author of all good, author of no evil, and unchangeable. According to Anaxagoras there was a confuſed maſs of all things in one chaos, but mind ſupervening, ἐπελθὼν, diſtinguiſhed and divided them Anaxagoras, it ſeems aſcribed the motive faculty to mind, which mind ſome ſubſequent philoſophers have accurately diſcriminated from ſoul and life, aſcribing to it the ſole faculty of intellection.

* Sect. 250, 270.

321. But

321. But ſtill God was ſuppoſed the firſt agent, the ſource and original of all things which he produceth, not occaſionally or inſtrumentally, but with actual and real efficacy. Thus the treatiſe, *De ſecretiore parte divinæ ſapientiæ ſecundum Ægyptios*, in the tenth book, ſaith of God, that he is not only the firſt agent, but alſo that he it is who truly acts or creates, *qui verè efficit.*

322. Varro, Tully, and St. Auguſtin underſtand the ſoul to be *vis*, the power, or force that acts, moves, enlivens. Now although, in our conception, *vis*, or ſpirit might be diſtinguiſhed from mind, it would not thence follow, that is acts blindly or without mind, or that it is not cloſely connected with intellect. If Plutarch is to be truſted in his account of the opinions of philoſophers; Thales held the mind of the world to be God: Democritus held the ſoul of the world to be an igniform deity *. Pythagoras taught that God was the monad and the good, or τ' αγαθὸν: Socrates alſo and Plato pronounced him to be the τὸ ἕν †, the ſingle, ſelf originate one, eſſentially good. Each of which appellations and forms of ſpeech directly tends to, and determines in mind, εἰς τὸν νοῦν πείθει ſaith Plutarch.

323. Whence that author concludes, that in the ſenſe of thoſe philoſophers God is a mind, χωριστὸν εἶδος, not an abſtract idea compounded of inconſiſtencies and preſcinded from all real things, as ſome moderns underſtand abſtraction; but a really exiſting ſpirit, diſtinct or ſeparate from all ſenſible and corporeal beings. And although the Stoics are repreſented as holding a corporeal deity, or that the very ſyſtem of the world is God, yet it is certain they did not, at bottom, diſſent from the forementioned doctrine; inaſmuch as they ſuppoſed the world to be an animal ‡, conſiſting of ſoul or mind as well as body.

* Sect. 166, 168, 277. † Sect. 287. ‡ Sect. 276, 279.

324. This notion was derived from the Pythagoreans, who held the world, as Timæus Locrus teacheth, to be one perfect animal, endued with ſoul and reaſon: but then they believed it to have been generated: Whereas the Stoics looked on the world as the ſupreme God, including therein mind or intellect. For the elementary fire, or, if one may ſo ſpeak, the animal ſpirit of the world, ſeemeth according to them, to have been the vehicle of the ſoul *, intellect or νοῦς; ſince they ſtyled the divinity πῦρ νοερὸν † or intellectual fire.

325. The Ægyptians, if we may credit the Hermaic writings, maintained God to be all things, not only actual but poſſible. He is ſtyled by them, that which is made and that which is unmade. And therein it is ſaid, ſhall I praiſe thee for thoſe things thou haſt made manifeſt, or for the things thou haſt hidden? Therefore, in their ſenſe, to manifeſt, was to create; the things created having been before hidden in God.

326. Now, whether the νοῦς be abſtracted from the ſenſible world, and conſidered by itſelf, as diſtinct from, and preſiding over the created ſyſtem, or whether the whole univerſe, including mind together with the mundane body, is conceived to be God ‡, and the creatures to be partial manifeſtations of the divine eſſence, there is no atheiſm in either caſe, whatever miſconceptions there may be; ſo long as mind or intellect is underſtood to preſide over, govern, and conduct the whole frame of things. And this was the general prevailing opinion among the philoſophers.

327. Nor if any one, with Ariſtotle in his metaphyſics, ſhould deny that God knows any thing without himſelf; ſeeing that God comprehends all things, could this be juſtly pronounced an atheiſtical opinion. Nor even was the following notion of the ſame author to be accounted

* Sect. 277, 284. † Sect. 272. ‡ Sect. 300.

atheiſm

atheiſm, to wit, that there are ſome things beneath the knowledge of God, as too mean, baſe, and vile; however wrong this notion may be, and unworthy of the divine perfection.

328. Might we not conceive that God may be ſaid to be all in divers ſenſes; as he is the cauſe and origin of all beings; as the νοῦς is the νοητὰ a doctrine both of Platonics and Peripatetics * as the νοῦς is the place of all forms, and as it is the ſame which comprehends and orders † and ſuſtains the whole mundane ſyſtem. Ariſtotle declares, that the divine force or influence permeates the intire univerſe ‡, and that what the pilot is in a ſhip, the driver in a chariot, the precentor in a choir, the law in a city, the general in an army, the ſame God is in the world. This he amply ſets forth in his book *de mundo*, a treatiſe which having been anciently aſcribed to him, ought not to be ſet aſide from the difference of ſtyle, which (as Patricius rightly obſerves) being in a letter to a king, might well be ſuppoſed to differ from the other dry and crabbed parts of his writings.

329. And although there are ſome expreſſions to be met with in the philoſophers, even of the Platonic and Ariſtotelic ſects, which ſpeak of God as mixing with, or pervading all nature and all the elements; yet this muſt be explained by force and not by extenſion, which was never attributed to the mind § either by Ariſtotle or Plato. This they always affirmed to be incorporeal: and, as Plotinus remarks, incorporeal things are diſtant each from other not by place, but (to uſe his expreſſion) by alterity.

330. Theſe diſquiſitions will probably ſeem dry and uſeleſs, to ſuch readers as are accuſtomed to conſider only ſenſible objects. The employ-

* Sect. 309, 310. † Sect. 320. ‡ Sect. 173. § Sect. 290, 293, 297, 319.

ment of the mind on things purely intellectual is to moſt men irkſome: whereas the ſenſitive powers, by conſtant uſe acquire ſtrength. Hence, the objects of ſenſe more forcibly affect us *, and are too often counted the chief good. For theſe things men fight, cheat, and ſcramble. Therefore, in order to tame mankind and introduce a ſenſe of virtue, the beſt human means is to exerciſe their underſtanding, to give them a glimpſe of another world, ſuperior to the ſenſible, and while they take pains to cheriſh and maintain the animal life, to teach them not to neglect the intellectual.

331. Prevailing ſtudies are of no ſmall conſequence to a ſtate, the religion, manners and civil government of a country ever taking ſome bias from from its philoſophy, which affects not only the minds of its profeſſors and ſtudents, but alſo the opinions of all the better ſort, and the practice of the whole people, remotely and conſequentially indeed, though not inconſiderably. Have not the polemic and ſcholaſtic philoſophy been obſerved to produce controverſies in law and religion? And have not Fataliſm and Sadduciſm gained ground, during the general paſſion for the Corpuſcularian and mechanical philoſophy, which hath prevailed for about a century? This indeed might uſefully enough have employed ſome ſhare of the leiſure and curioſity of inquiſitive perſons. But when it entered the ſeminaries of learning as a neceſſary accompliſhment, and moſt important part of education, by engroſſing men's thoughts, and fixing their minds ſo much on corporeal objects, and the laws of motion, it hath, however undeſignedly, indirectly, and by accident, yet not a little indiſpoſed them for ſpiritual, moral, and intellectual matters. Certainly had the philoſophy of Socrates and Pythagoras prevailed in this age, among thoſe who think themſelves too wiſe to receive the dictates of the goſpel, we ſhould not have ſeen intereſt take ſo gene-

* Sect. 264, 294.

ral

ral and faſt hold on the minds of men, nor public ſpirit reputed to be γενναῖαν ἐυήθειαν a generous folly among thoſe who are reckoned to be the moſt knowing as well as the moſt getting part of mankind.

332. It might very well be thought ſerious trifling to tell my readers that the greateſt men had ever an high eſteem for Plato; whoſe writings are the touchſtone of a haſty and ſhallow mind; whoſe philoſophy has been the admiration of ages; which ſupplied patriots, magiſtrates, and lawgivers to the moſt flouriſhing ſtates, as well as fathers to the church, and doctors to the ſchools. Albeit in theſe days, the depths of that old learning are rarely fathomed, and yet it were happy for theſe lands, if our young nobility and gentry inſtead of modern maxims would imbibe the notions of the great men of antiquity. But in theſe freethinking times many an empty head is ſhook at Ariſtotle and Plato, as well as at the holy ſcriptures. And the writings of thoſe celebrated ancients are by moſt men treated on a foot, with the dry and barbarous lucubrations of the ſchoolmen. It may be modeſtly preſumed, there are not many among us, even of thoſe who are called the better ſort, who have more ſenſe, virtue, and love of their country than Cicero, who in a letter to Atticus could not forbear exclaiming, *O Socrates et Socratici viri! nunquam vobis gratiam referam.* Would to God many of our countrymen had the ſame obligations to thoſe Socratic writers. Certainly where the people are well educated, the art of piloting a ſtate is beſt learned from the writings of Plato. But among bad men void of diſcipline and education, Plato, Pythagoras and Ariſtotle themſelves, were they living, could do but little good. Plato hath drawn a very humorous and inſtructive picture of ſuch a ſtate; which I ſhall not tranſcribe for certain reaſons. But whoever has a mind, may ſee it in the ſeventy-eighth page of the ſecond tome of Aldus's edition of Plato's works.

333. Proclus,

333. Proclus, in the firſt book of his commentary on the theology of Plato obſerves that, as in the myſteries, thoſe who are initiated, at firſt meet with manifold and multiform Gods, but being entered and thoroughly initiated they receive the divine illumination and participate the very deity: in like manner, if the ſoul looks abroad ſhe beholds the ſhadows and images of things: but returning into herſelf ſhe unravels and beholds her own eſſence: at firſt ſhe ſeemeth only to behold herſelf: but having penetrated farther ſhe diſcovers the mind. And again, ſtill farther advancing into the innermoſt ſanctuary of the ſoul ſhe contemplates the θεῶν γένος. And this, he ſaith, is the moſt excellent of all human acts, in the ſilence and repoſe of the faculties of the ſoul to tend upwards to the very divinity; to approach and be cloſely joined with that which is ineffable and ſuperior to all beings. When come ſo high as the firſt principle ſhe ends her journey and reſts. Such is the doctrine of Proclus.

334. But Socrates in the firſt Alcibiades teacheth on the other hand, that the contemplation of God is the proper means to know or underſtand our own ſoul. As the eye, ſaith he, looking ſtedfaſtly at the viſive part or pupil of another eye beholds itſelf, even ſo the ſoul beholds and underſtands herſelf, while ſhe contemplates the deity which is wiſdom and virtue or like thereunto. In the Phædon, Socrates ſpeaks of God as being τ' ἀγαθὸν and τὸ θεῖον *, Plotinus repreſents God as order: Ariſtotle as law.

335. It may ſeem perhaps to thoſe, who have been taught to diſcourſe about ſubſtratums, more reaſonable and pious to attribute to the deity a more ſubſtantial being, than the notional entities of wiſdom, order, law, virtue, or goodneſs, which being only complex ideas, framed and put together by the underſtanding, are its own creatures, and have nothing ſubſtantial, real, or independent in them. But it muſt be conſidered,

* Sect. 260, 320.

that

that in the Platonic ſyſtem, order, virtue, law, goodneſs, and wiſdom are not creatures of the ſoul of man, but innate and originally exiſtent therein, not as an accident in a ſubſtance, but as light to enlighten, and as a guide to govern. In Plato's ſtyle, the term idea doth not merely ſignify an inert inactive object of the underſtanding, but is uſed as ſynonymous with αἴτιον and ἀρχὴ, cauſe and principle. According to that philoſopher, goodneſs, beauty, virtue, and ſuch like are not figments of the mind, nor mere mixed modes, nor yet abſtract ideas in the modern ſenſe, but the moſt real beings, intellectual and unchangeable: and therefore more real than the fleeting tranſient objects of ſenſe *, which wanting ſtability cannot be ſubjects of ſcience †, much leſs of intellectual knowledge.

336. By Parmenides, Timæus, and Plato, a diſtinction was made, as hath been obſerved already, between *genitum* and *ens*. The former ſort is always a generating or *in fieri* ‡, but never exiſts, becauſe it never continues the ſame, being in a conſtant change, ever periſhing and producing. By *entia* they underſtand things remote from ſenſe, inviſible and intellectual, which never changing are ſtill the ſame, and may therefore be ſaid truly to exiſt, οὐσία which is generally tranſlated ſubſtance, but more properly eſſence, was not thought to belong to things ſenſible and corporeal, which have no ſtability; but rather to intellectual ideas though diſcerned with more difficulty, and making leſs impreſſion on a mind ſtupified and immerſed in animal life, than groſs objects that continually beſet and ſolicit our ſenſes.

337. The moſt refined human intellect exerted to its utmoſt reach can only ſeize ſome imperfect glimpſes § of the divine ideas, abſtracted from all things corporeal, ſenſible, and imaginable. Therefore Pythagoras and Plato treated them in a myſterious manner, concealing rather than ex-

* Sect. 306. † Sect. 264, 266, 297. ‡ Sect. 304, 306. § Sect. 313, 330.

poſing

poſing them to vulgar eyes; ſo far were they from thinking, that thoſe abſtract things, although the moſt real, were the fitteſt to influence common minds, or become principles of knowledge, not to ſay duty and virtue to the generality of mankind.

338. Ariſtotle and his followers have made a monſtrous repreſentation of the Platonic ideas; and ſome of Plato's own ſchool have ſaid very odd things concerning them. But if that philoſopher himſelf was not read only, but ſtudied alſo with care, and made his own interpreter, I believe the prejudice that now lies againſt him would ſoon wear off *, or be even converted into high eſteem for thoſe exalted notions and fine hints, that ſparkle and ſhine throughout his writings; which ſeem to contain not only the moſt valuable learning of Athens and Greece, but alſo a treaſure of the moſt remote traditions and early ſcience of the Eaſt.

339. In the Timæus of Plato mention is made of ancient perſons, authors of traditions, and the offspring of the Gods. It is very remarkable, that in the account of the creation contained in the ſame piece, it is ſaid that God was pleaſed with his work, and that the night is placed before the day. The more we think, the more difficult ſhall we find it to conceive, how mere man, grown up in the vulgar habits of life, and weighed down by ſenſuality, ſhould ever be able to arrive at ſcience, without ſome tradition † or teaching, which might either ſow the ſeeds of knowledge, or call forth and excite thoſe latent ſeeds that were originally ſown in the ſoul.

340. Human ſouls in this low ſituation, bordering on mere animal life, bear the weight and ſee through the duſk of a groſs atmoſphere, gathered from wrong judgments daily paſſed, falſe opinions daily learned, and early

* Sect. 309, 313. † Sect. 298, 301, 302.

habits

habits of an older date than either judgment or opinion. Through ſuch a medium the ſharpeſt eye cannot ſee clearly *. And if by ſome extraordinary effort the mind ſhould ſurmount this duſky region, and ſnatch a glimpſe of pure light, ſhe is ſoon drawn backward and depreſſed by the heavineſs of the animal nature, to which ſhe is chained. And if again ſhe chanceth, amidſt the agitation of wild fancies and ſtrong affections, to ſpring upwards, a ſecond relapſe ſpeedily ſucceeds into this region of darkneſs and dreams.

341. Nevertheleſs, as the mind gathers ſtrength by repeated acts, we ſhould not deſpond, but continue to exert the prime and flower of our faculties, ſtill recovering, and reaching on, and ſtruggling into the upper region, whereby our natural weakneſs and blindneſs may be in ſome degree remedied, and a taſte attained of truth and intellectual life. Beſide the conſtant prevailing opinion of the greateſt men of antiquity, that there is both an univerſal ſpirit author of life and motion, and an univerſal mind enlightening and ordering all things, it was a received tenet among them, that there is alſo τὸ ἓν or τ' αγαθὸν †, which they looked on as the *fons deitatis*, the firſt hypoſtaſis in the divinity.

342. The one or τὸ ἓν, being immutable and indiviſible, always the ſame and entire, was therefore thought to exiſt truly and originally, and other things only ſo far as they are one and the ſame, by participation of τὸ ἓν. This gives unity, ſtability, reality to things ‡. Plato deſcribes God, as Moſes, from his being. According to both, God is he who truly is, ὁ ὄντως ὤν. Change and diviſion were eſteemed defects or bad. Evil ſcatters, divides, deſtroys. Good, on the contrary, produceth concord and union, aſſembles, combines, perfects, and preſerves entire. The ſeveral beings which compoſe the univerſe are parts of the ſame ſyſtem, they combine to carry on one end, and perfect one whole. And this aptneſs

* Sect. 292, 293, 294. † Sect. 322. ‡ Sect. 264, 306.

and concurrence thereunto furniſhes the partial particular idea of good in the diſtinct creatures. Hence it might have come to paſs, that τ' αγαθον and τὸ ἓν were regarded as one and the ſame.

343. Light and ſight (ſaith Plato in the ſixth book of his republic) are not the ſun: even ſo truth and knowledge are not the good itſelf, although they approach thereunto. And again, what the ſun is in a viſible place with reſpect to ſight and things ſeen, that ſame is τ' αγαθὸν or good in an intelligible place, with reſpect to underſtanding and things underſtood. Therefore the good or one is not the light that enlightens, but the ſource of that light.

344. Every moment produceth ſome change in the parts of this viſible creation. Something is added or diminiſhed, or altered in eſſence, quantity, quality, or habitude. Wherefore all generated beings were ſaid by the ancients to be in a perpetual flux *. And that which, on a confuſed and general view, ſeems one ſingle conſtant being, ſhall upon a nearer inſpection appear a continued ſeries of different beings. But God remains for ever one and the ſame. Therefore God alone exiſts. This was the doctrine of Heraclitus, Plato, and other ancients.

345. It is the opinion of Plato and his followers, that in the ſoul of man, prior and ſuperior to intellect, there is ſomewhat of an higher nature, by virtue of which we are one; and that by means of our one or unite, we are moſt cloſely joined to the deity. And, as by our intellect we touch the divine intellect, even ſo by our τὸ ἓν or unite the very flower of our eſſence, as Proclus expreſſeth it, we touch the firſt one.

346. According to the Platonic philoſophy, *ens* and *unum* are the ſame. And conſequently our minds participate ſo far of exiſtence as they do of

* Sect. 304, 336.

unity.

unity. But it ſhould ſeem that perſonality is the indiviſible center of the ſoul or mind, which is a monad ſo far forth as ſhe is a perſon. Therefore perſon is really that which exiſts, inaſmuch as it participates the divine unity. In man the monad or indiviſible is the αὐτο το αυτό the ſelf ſame ſelf or very ſelf, a thing in the opinion of Socrates, much and narrowly to be inquired into and diſcuſſed, to the end that, knowing ourſelves, we may know what belongs to us and our happineſs.

347. Upon mature reflexion the perſon or mind, of all created beings, ſeemeth alone indiviſible, and to partake moſt of unity. But ſenſible things are rather conſidered as one than truly ſo, they being in a perpetual flux or ſucceſſion, ever differing and various. Nevertheleſs all things together may be conſidered as one univerſe *, one by the connexion, relation, and order of its parts, which is the work of mind, whoſe unite is by Platonics, ſuppoſed a participation of the firſt τὸ ἕν.

348. Socrates, in the Theætetus of Plato, ſpeaketh of two parties of philoſophers, the ῥέοντες and οἱ τὸν ὅλον ϛασιῶται, the flowing philoſophers who held all things to be in a perpetual flux, always a generating and never exiſting; and thoſe others who maintained the univerſe to be fixed and immoveable. The difference ſeems to have been this, that Heraclitus, Protagoras, Empedocles, and in general thoſe of the former ſect, conſidered things ſenſible and natural; whereas Parmenides and his party conſidered τὸ πᾶν, not as the ſenſible but as the intelligible world †, abſtracted from all ſenſible things.

349. In effect, if we mean by things the ſenſible objects; theſe, it is evident, are always flowing; but if we mean things purely intelligible, then we may ſay on the other hand, with equal truth, that they are immoveable and unchangeable. So that thoſe, who thought the whole or

* Sect. 287, 288. † Sect. 293, 294, 295.

τὸ πᾶν to be ἓν ἕστως a fixed or permanent one, ſeem to have underſtood the whole of real beings, which in their ſenſe was only the intellectual world, not allowing reality of being to things not permanent.

350. The diſpleaſure of ſome readers may perhaps be incurred, by ſurpriſing them into certain reflexions and inquiries for which they have no curioſity. But perhaps ſome others may be pleaſed, to find a dry ſubject varied by digreſſions, traced through remote inferences, and carried into ancient times, whoſe hoary maxims * ſcattered in this eſſay are not propoſed as principles, but barely as hints to awaken and exerciſe the inquiſitive reader, on points not beneath the attention of the ableſt men. Thoſe great men, Pythagoras, Plato, and Ariſtotle, the moſt conſummate in politics, who founded ſtates, or inſtructed princes, or wrote moſt accurately on public government, were at the ſame time moſt acute at all abſtracted and ſublime ſpeculations; the cleareſt light being ever neceſſary to guide the moſt important actions. And whatever the world thinks, he who hath not much meditated upon God, the human mind, and the *ſummum bonum*, may poſſibly make a thriving earthworm, but will moſt indubitably make a ſorry patriot and a ſorry ſtateſman.

351. According to the nice metaphyſics of thoſe ancient philoſophers τὸ ἕν, being conſidered as what was firſt and ſimpleſt in the deity, was preſcinded even from entity to which it was thought prior and ſuperior; and is therefore by the Platonics ſtyled ſupereſſential. And in the Parmenides it is ſaid, τὸ ἕν doth not exiſt; which might ſeem to imply a negation of the divine being. The truth is, Zeno and Parmenides argued, that a thing exiſting in time was older and younger than itſelf; therefore the conſtant immutable τὸ ἕν did not exiſt in time; and if not in time, then in none of the differences of time paſt, preſent, or to come; there-

* Sect. 298, 301.

fore

fore we cannot ſay that it was, is, or will be. But nevertheleſs it is admitted in the ſame Parmenides, that τὸ νῦν is every where preſent to τὸ ἕν; that is, inſtead of a temporary ſucceſſion of moments, there is one eternal now, or, *punctum ſtans*, as it is termed by the ſchoolmen.

352. The ſimplicity of τὸ ἕν (the father in the Pythagoric and Platonic trinity) is conceived ſuch as to exclude intellect or mind, to which it is ſuppoſed prior. And that hath created a ſuſpicion of atheiſm in this opinion. For ſaith the learned doctor Cudworth, ſhall we ſay that the firſt hypoſtaſis or perſon is ἄνους and ἄλογος, ſenſeleſs and irrational, and altogether devoid of mind and underſtanding? or would not this be to introduce a kind of myſterious atheiſm? To which it may be anſwered, that whoever acknowledgeth the univerſe to be made and governed by an eternal mind, cannot be juſtly deemed an atheiſt *. And this was the tenet of thoſe ancient philoſophers. In the Platonic doctrine, the generation of the νοῦς or λόγος was not contingent but neceſſary, not temporary, but from everlaſting. There never was a time ſuppoſed wherein τὸ ἕν ſubſiſted without intellect, the priority having been underſtood only as a priority of order or conception, but not a priority of age. Therefore, the maintaining a diſtinction of priority between τὸ ἕν and νοῦς doth not infer, that the one ever exiſted without the other. It follows, therefore, that the father or τὸ ἕν may, in a certain ſenſe, be ſaid to be ἄνους without atheiſm, or without deſtroying the notion of a deity; any more than it would deſtroy the notion of a human ſoul, if we ſhould conceive a diſtinction between ſelf and intellect, or intellect and life. To which we may farther add, that it is a doctrine of Platonics, and agrees with their maſter's tenets, to ſay that τὸ ἕν or the firſt hypotheſis contains all excellence and perfection whereof it is the original ſource, and is more eminent, as the ſchools ſpeak, intellect and life, as well as goodneſs; while the ſecond hypoſtaſis is eſſentially intellect, and by participation

* Sect. 154, 276, 279, 287.

goodneſs

goodneſs and life; and the third, life eſſentially, and by participation goodneſs and intellect.

353. Therefore, the whole being conſidered, it will not ſeem juſt, to fix the imputation of atheiſm upon thoſe philoſophers, who held the doctrine of τὸ ἕν; whether it be taken in an abſtracted or collective, a metaphyſical or merely vulgar, meaning *; that is, whether we preſcind unity from eſſence and intellect, ſince metaphyſical diſtinctions of the divine attributes do not in reality divide them; or whether we conſider the univerſal ſyſtem of beings as one, ſince the union, connexion, and order of its members, do manifeſtly infer a mind or intellect to be cauſe thereof.

354. The one or τὸ ἕν may be conceived either by compoſition or diviſion. For as, on the one hand, we may ſay the world or univerſe is ONE whole or ONE animal; ſo we may, on the other hand, conſider τὸ ἕν by diviſion or abſtraction, as ſomewhat in the order of things prior to mind. In either ſenſe there is no atheiſm, ſo long as mind is admitted to preſide and direct the animal; and ſo long as the *unum* or τὸ ἕν is ſuppoſed not to exiſt without mind †. So that neither Heraclitus nor Parmenides, nor Pythagoras nor Plato, neither the Ægyptians nor Stoics, with their doctrine, of a divine whole or animal, nor Xenophanes with his ἓν καὶ πᾶν, are juſtly to be accounted atheiſts. Therefore modern atheiſm, be it of Hobbes, Spinoſa, Collins, or whom you will, is not to be countenanced by the learning and great names of antiquity.

355 Plato teacheth, that the doctrine concerning the one or unite is a means, to lead and raiſe the mind ‡ to the knowledge of him who truly is. And it is a tenet both of Ariſtotle and Plato, that identy is a certain

* Sect. 300. † Sect. 287, 288. ‡ Sect. 294, 295.

unity.

unity. The Pythagoreans alſo, as well as the Platonic philoſophers, held *unum* and *ens* to be the ſame. Conſiſtently with which, that only can be ſaid to exiſt, which is one and the ſame. In things ſenſible and imaginable, as ſuch, there ſeems to be no unity, nothing, that may be called one prior to all act of the mind; ſince they being in themſelves aggregates, conſiſting of parts or compounded of elements, are in effect many. Accordingly it is remarked by Themiſtius, the learned interpreter of Ariſtotle, that to collect many notions into one, and to conſider them as one, is the work of intellect and not of ſenſe or fancy.

356. Ariſtotle himſelf, in his third book of the ſoul, ſaith it is the mind that maketh each thing to be one, τὸ δὲ ἓν ποιοῦν τοῦτο ὁ νοῦς ἕκαστον. How this is done, Themiſtius is more particular, obſerving, that as being conferreth eſſence, the mind by virtue of her ſimplicity conferreth ſimplicity upon compounded beings. And, indeed, it ſeemeth that the mind, ſo far forth as perſon, is individual *, therein reſembling the divine one by participation, and imparting to other things what itſelf participates from above. This is agreeable to the doctrine of the ancients, however the contrary opinion of ſuppoſing number to be an original primary quality in things, independent of the mind, may obtain among the moderns.

357. The Peripatetics taught, that in all diviſible things there was ſomewhat indiviſible, and in all compounded things ſomewhat ſimple. This they derived from an act of the mind. And neither this ſimple indiviſible unite, nor any ſum of repeated unites, conſequently no number can be ſeparated from the things themſelves and from the operation of the mind. Themiſtius goeth ſo far as to affirm, that it cannot be ſeparated from the words or ſigns; and, as it cannot be uttered without them, ſo ſaith he, neither can it be conceived without them. Thus

* Sect. 345, 346, 347.

much

much upon the whole may be concluded, that distinct from the mind and her operations, there is in created beings neither unite nor number.

358. Of inferier beings the human mind, self, or person is the most simple and undivided essence *. And the supreme father is the most perfect one. Therefore the flight of the mind towards God is called by the Platonics φυγὴ μόνου πρὸς μόνον. The supreme being, saith Plotinus, as he excludes all diversity is ever alike present. And we are then present to him, when, recollected and abstracted from the world and sensible objects, we are most free and disengaged † from all variety. He adds, that in the intuition of the supreme deity the soul finds her wished for end and repose; which that philosopher calls awaking out of his body into himself.

359. In the tenth book of the arcane, or divine wisdom of the Ægyptians, we are taught that the supreme being is not the cause of any created thing; but that he produced or made the word; and that all created beings were made by the word, which is accordingly styled the cause of all causes: and that this was also the doctrine of the Chaldeans. Plato, likewise, in his letter to Hermias, Erastus, and Coriscus, speaks of God the ruler and cause of all things as having a father: and, in his Epinomis, he expressly teacheth that the word or λόγος made the world. Accordingly Saint Augustine in his commentary on the beginning of Saint John's Gospel, having declared that Christ is the wisdom of God by which all things were made, observes that this doctrine was also found in the writings of philosophers, who taught that God had an only begotten Son by whom are all things.

360. Now, though Plato had joined with an imagination the most splendid and magnificent an intellect not less deep and clear; yet it is

* Sect. 347. † Sect. 268.

not

not to be ſuppoſed, that either he or any other philoſophers of Greece or the Eaſt, had by the light of nature attained an adequate notion of the Holy Trinity, nor even that their imperfect notion, ſo far as it went, was exactly juſt; nor perhaps that thoſe ſublime hints, which dart forth like flaſhes of light in the midſt of a profound darkneſs, were originally ſtruck from the hard rock of human reaſon; but rather derived, at leaſt in part, by a divine tradition * from the author of all things. It ſeems a remarkable confirmation of this, what, Plotinus obſerved in his fifth Æneid, that this doctrine of a Trinity, father, mind, and ſoul, was no late invention, but an ancient tenet.

361. Certain it is, that the notion of a Trinity is to be found in the writings of many old heathen philoſophers, that is to ſay, a notion of three divine hypoſtaſes. Authority, light, and life did, to the eye of reaſon, plainly appear to ſupport, pervade and animate the mundane ſyſtem or macrocoſm. The ſame appeared in the microcoſm, preſerving ſoul and body, enlightening the mind, and moving the affections. And theſe were conceived to be neceſſary univerſal principles, coexiſting, and cooperating in ſuch ſort, as never to exiſt aſunder, but on the contrary to conſtitute one ſovereign of all things. And, indeed, how could power or authority avail or ſubſiſt without knowledge? or either without life and action?

362. In the adminiſtration of all things there is authority to eſtabliſh, law to direct, and juſtice to execute. There is firſt the ſource of all perfection, or *fons deitatis*, ſecondly the ſupreme reaſon, order, or λογος, and laſtly the ſpirit which quickens and inſpires. We are ſprung from the father, irradiated or enlightened by the ſon, and moved by the ſpirit. Certainly, that there is father, ſon, and ſpirit; that theſe bear analogy to the ſun, light, and heat; and are otherwiſe expreſſed by the terms

* Sect. 298, 301.

principle, mind, and ſoul; by one or τὸ ἕν, intellect, and life; by good, word, and love; and that generation was not attributed to the ſecond hypoſtaſis, the νοῦς or λόγος, in reſpect of time *, but only in reſpect of origin and order, as an eternal neceſſary emanation; theſe are the expreſs tenets of Platoniſts, Pythagoreans, Ægyptians, and Chaldeans.

363. Though it may be well preſumed there is nothing to be found on that ſublime ſubject in human writings, which doth not bear the ſure ſigtures of humanity; yet it cannot be denied, that ſeveral fathers of the church have thought fit to illuſtrate the chriſtian doctrine of the Holy Trinity, by ſimilitudes and expreſſions borrowed from the moſt eminent heathens, whom they conceived to have been no ſtrangers to that myſtery; as hath been plainly proved by Beſſarian, Eugubinus, and doctor Cudworth.

364. Therefore, how unphiloſophical ſoever that doctrine may ſeem to many of the preſent age yet it is certain, the men of greateſt fame and learning among the ancient philoſophers held a Trinity in the Godhead. It muſt be owned, that upon this point ſome later Platoniſts of the Gentile world ſeem to have bewildered themſelves, (as many Chriſtians have alſo done) while they purſued the hints derived from their predeceſſors, with too much curioſity.

365. But Plato himſelf conſidered that doctrine as a venerable myſtery, not to be lightly treated of, or raſhly divulged. Wherefore in a letter to Dionyſius he writes (as he himſelf profeſſeth) ænigmatically and briefly in the following terms, which he giveth for a ſummary of his notion concerning the ſupreme being, and which being capable of divers ſenſes, I leave to be decyphered by the learned reader. περὶ τὸν πάντων βασιλέα παντ' ἐστὶ, καὶ ἐκεῖνα ἕνεκα πάντα, καὶ ἐκεῖνο αἴτιον ἁπάντων τῶν καλῶν, δεύτερον δὲ περὶ τὰ δεύτερα, καὶ τρίτον περὶ τὰ τρίτα.

* Sect. 352.

τρίτα. Plato enjoins Dionyſius over and over, with great earneſtneſs not to ſuffer, what he communicates concerning the myſteries of the divine nature, to fall into illiterate or vulgar hands, giving it withal as a reaſon for this caution, that nothing would ſeem more ridiculous or abſurd to the common run of mankind. He adds, that in regard writings might miſcarry, the prudent way was to write nothing at all on thoſe matters, but to teach and learn them by word of mouth: for which reaſon, ſaith he, I have never wrote any thing thereon; nor is there, nor ſhall there ever be any thing of Plato's, extant on that ſubject. He farther adds, as for what hath been now ſaid, it belongs all to Socrates.

366. And, indeed, what this philoſopher in his Phædrus ſpeaketh of the ſuperceleſtial region, and the divinity reſident therein, is of a ſtrain not to be reliſhed or comprehended by vulgar minds; to wit, eſſence really exiſtent, object of intellect alone, without colour, without figure, without any tangible quality. He might very juſtly conceive that ſuch a deſcription muſt ſeem ridiculous to ſenſual men.

367. As for the perfect intuition of divine things, that he ſuppoſeth to be the lot of pure ſouls, beholding by a pure light, initiated, happy, free and unſtained from thoſe bodies, wherein we are now impriſoned like oyſters. But in this mortal ſtate, we muſt be ſatisfied to make the beſt of thoſe glimpſes * within our reach. It is Plato's remark in his Theætetus, that while we ſit ſtill we are never the wiſer, but going into the river and moving up and down, is the way to diſcover its depths and ſhallows. If we exerciſe and beſtir ourſelves, we may even here diſcover ſomething.

368. The eye by long uſe comes to ſee even in the darkeſt cavern: and there is no ſubject ſo obſcure, but we may diſcern ſome glimpſe of

* Sect. 335, 337.

truth by long poring on it. Truth is the cry of all, but the game of a few. Certainly where it is the chief paſſion, it doth not give way to vulgar cares and views; nor is it contented with a little ardour in the early time of life, active, perhaps, to purſue, but not ſo fit to weigh and reviſe. He that would make a real progreſs in knowledge, muſt dedicate his age as well as youth, the later growth as well as firſt fruits, at the altar of Truth.

Cujuſvis eſt errare, nullius niſi inſipientis in errore perſeverare.

Cic.

A

LETTER

TO

T---- P----, Eſq;

CONTAINING

Some farther Remarks on the VIRTUES of

TAR WATER,

AND

The METHODS for Preparing and Uſing it.

A

LETTER, &c.

1. AMONG the great numbers, who drink tar water in *Dublin*, your letter informs me, there are ſome, that make or uſe it in an undue manner. To obviate thoſe inconveniencies, and render this water as generally uſeful as poſſible, you deſire I would draw up ſome rules and remarks in a ſmall compaſs, which accordingly I here ſend you.

2. Pour a gallon of cold water on a quart of liquid tar, ſtir, mix, and work them thoroughly together, with a wooden ladle, or flat ſtick, for the ſpace of five or ſix minutes. Then let the veſſel ſtand cloſe covered three days and nights, that the tar may have full time to ſubſide. After which, having firſt carefully ſkimmed it, without moving the veſſel, pour off the clear water, and keep it in bottles, well corked, for uſe. This method will produce a liquor ſtronger than that firſt publiſhed in *Siris*, but not offenſive, if carefully ſkimmed. It is a good general rule, but as ſtomachs and conſtitutions are various, it may admit of ſome latitude. Leſs water or more ſtirring makes it ſtronger, as more water or leſs ſtirring makes it weaker. It is to be noted, that if ſeveral gallons are made at once in the ſame veſſel, you muſt add five or ſix minutes ſtirring for every gallon. Thus two gallons of water, and two quarts of tar require ten or twelve minutes ſtirring.

3. The

3. The ſame tar will not do ſo well a ſecond time, but may ſerve for other common uſes: the putting off tar that hath been uſed, for freſh tar, would be a bad fraud. To prevent which it is to be noted, that tar already uſed is of a lighter brown than other tar. The only tar that I have uſed is that from our northern colonies in *America*, and that from *Norway*, the latter being thinner, mixeth eaſier with water, and ſeems to have more ſpirit. If the former be made uſe of (as I have known it with good ſucceſs) the tar water will require longer ſtirring to make it.

4. Tar water when right, is not paler than *French* nor deeper coloured than *Spaniſh* white wine, and full as clear; if there be not a ſpirit very ſenſibly perceived in drinking, you may conclude the tar water is not good; if you would have it good, ſee it made yourſelf. Thoſe who begin with it, little and weak, may by habit come to drink more and ſtronger. According to the ſeaſon, or the humour of the patient, it may be drank either cold or warm; in colics, I take it to be beſt warm. If it diſguſts a patient warm, let him try it cold, and *vice verſa*. If at firſt it create to ſome ſqueamiſh perſons a little ſickneſs at ſtomach, or nauſeating, it may be reduced both in quality and quantity. In general, ſmall inconveniencies are either removed, or borne with ſmall trouble; it lays under no reſtraint as to air, exerciſe, clothes, or diet, and may be taken at all times in the year.

5. As to the quantity in common chronical indiſpoſitions, one pint of tar water a day may ſuffice, taken on an empty ſtomach, at two or four times, to wit, night and morning, and about two hours after dinner and breakfaſt; more may be taken by ſtrong ſtomachs. Alteratives in general, taken in ſmall doſes, and often, mix beſt with the blood; how oft or how ſtrong each ſtomach can bear, experience will ſhew. But thoſe who labour under great and inveterate maladies, muſt drink a greater quantity, at leaſt one quart every twenty-four hours, taken at four, ſix, or eight

eight glaſſes, as beſt ſuits the circumſtances and caſe of the drinker. All of this claſs muſt have much patience and perſeverance in the uſe of this, as well as of all other medicines, which, if ſure and ſafe, muſt yet, from the nature of things, be ſlow in the cure of inveterate chronical diſorders. In acute caſes, fevers of all kinds, it muſt be drank in bed warm, and in great quantity, the fever ſtill enabling the patient to drink, perhaps a pint every hour, which I have known to work ſurpriſing cures. But it works ſo quick, and gives ſuch ſpirits, that the patients often think themſelves cured before the fever hath quite left them. Such therefore ſhould not be impatient to riſe, or apply themſelves too ſoon to buſineſs, or their uſual diet.

6. To ſome, pehaps, it may ſeem, that a ſlow alterative in chronical caſes cannot be depended on in fevers and acute diſtempers, which demand immediate relief. But I affirm that this ſame medicine, which is a ſlow alterative in chronical caſes, I have found to be alſo a moſt immediate remedy, when copiouſly taken, in acute and inflammatory caſes. It might indeed be thought raſh to have tried it in the moſt threatening fevers and pleuriſies without bleeding, which in the common practice would have been held neceſſary. But for this I can ſay, that I had patients who would not be bled, and this obliged me to make trials of tar water without bleeding, which trials I never knew unſucceſsful. The ſame tar water I found a ſlow alterative, and a ſudden febrifuge. If the reader is ſurpriſed, I own myſelf to be ſo too. But truth is truth, and from whatever hand it comes ſhould be candidly received. If phyſicians think they have a right to treat of religious matters, I think I have an equal right to treat of medicine.

7. Authority I have no pretence to. But reaſon is the common birthright of all. My reaſons I have given in *Siris*. My motives every one will interpret from his own breaſt. But he muſt own himſelf a very bad

man, who in my caſe (that is, after long experience, and under full conviction of the virtues and innocence of tar water) would not have done as much. All men are, I will not ſay allowed, but, obliged to promote the common benefit. And for this end, what I could not in conſcience conceal, that I do and ſhall publicly declare, maugre all the ſpleen and raillery of a world, which cannot treat me worſe, than it hath done my betters.

8. As the morning's draught is moſt difficult to nice ſtomachs, ſuch may leſſen, or even omit it at the beginning, or rather poſtpone it till after breakfaſt, and take a larger doſe at night; the diſtance from meal time need not be more than one hour, for common ſtomachs, when the liquor is well clarified and ſkimmed. The oil that floated on the top and was ſkimmed off, ſhould be carefully laid by, and kept for outward ſores. In the variety of caſes and conſtitutions, it is not amiſs that there ſhould be different manners of preparing and taking tar water. Trial will direct to the beſt: whether there be any difference between old tar or new tar, or which of all the various tars, produced from different trees, or in different parts of the world, is moſt medicinal, future trials muſt determine.

9. I have made a ſecond ſort of tar water, to be uſed externally, as a waſh or lotion for the itch, ſcabs, ulcers, evil, leproſy, and all ſuch foul caſes, which I have tried with very good ſucceſs, and recommend it to the trial of others. For inveterate caſes of that kind, tar water ſhould be drank, a quart every twenty-four hours, at four, ſix or eight glaſſes: and after this hath been done at leaſt for a fortnight, the lotion is to be applied outwardly, and warm, by bathing, fomenting and ſteeping, and this ſeveral times in the twenty-four hours, to heal and dry up the ſores, the drinking being ſtill continued. This water, for external uſe, is made in the following manner: pour two quarts of hot boiling water on a quart

quart of tar, ſtir and work it ſtrongly with a flat ſtick or ladle, a full quarter of an hour; let it ſtand ſix hours, then pour it off, and keep it cloſe covered for uſe. It may be made weaker or ſtronger as there is occaſion.

10. From what I have obſerved of the lotion, I am inclined to think, it may be worth while in obſtinate cutaneous ailments, leproſy and weakneſs of limbs, to try a bath of tar water; allowing a gallon of tar to every ten gallons of boiling hot water; ſtirring the ingredients a full half hour; ſuffering the veſſel to ſtand eight or ten hours, before the water is poured off; and uſing the bath a little more than milk warm. This experiment may be made in different proportions of tar and water. In *Dublin* many caſes occur for trial, which are not to be met with here in the country.

11. My experiments have been made in various caſes, and on many perſons; and I make no doubt its virtues will ſoon be more fully diſcovered, as tar water is now growing into general uſe, though not without that oppoſition which uſually attends upon novelty. The great objection I find made to this medicine is, that it promiſes too much. What, ſay the objectors, do you pretend to a panacea, a thing ſtrange, chimerical, and contrary to the opinion and experience of all mankind? Now to ſpeak out, and give this objection or queſtion a plain and direct anſwer, I freely own that I ſuſpect tar water is a panacea. I may be miſtaken, but it is worth trial: for the chance of ſo great and general a benefit, I am willing to ſtand the ridicule of propoſing it. And as the old philoſopher cried aloud, from the houſe-tops, to his fellow citizens, *educate your children*; ſo, I confeſs, if I had a ſituation high enough, and a voice loud enough, I would cry out, to all the valetudinarians upon earth, *drink tar water*.

12. Having thus frankly owned the charge, I muſt explain to you, that by a panacea is not meant a medicine which cures all individuals, (this conſiſts not with mortality) but a medicine that cures or relieves all the different ſpecies of diſtempers. And if God hath given us ſo great a bleſſing, and made a medicine ſo cheap and plenty as tar, to be with all ſo univerſal in its effects, to eaſe the miſeries of human life, ſhall men be ridiculed or bantered out of its uſe, eſpecially when they run no riſque in the trial. For I can truly affirm, that I never knew any harm attend it more than ſometimes a little nauſea, which if the liquor be well cleared, ſkimmed, and bottled, need not, I think, be apprehended.

13. It muſt be owned I have not had opportunities of trying it myſelf in all caſes, neither will I undertake to demonſtrate *a priori*, that tar water is a panacea. But yet methinks I am not quite deſtitute of probable reaſons, which, joined to what facts I have obſerved, induced me to entertain ſuch a ſuſpicion.

14. I knew tar was uſed to preſerve cattle from contagion; and this may be ſuppoſed to have given riſe to that practice of drinking tar water for a preſervative againſt the ſmall-pox. But as the tar water uſed for that purpoſe was made by mixing equal quantities of tar and water, it proved a moſt offenſive potion; beſides, as a freſh glaſs of water was put in for each glaſs that was taken out, and this for many days on the ſame tar, it follows that the water was not equally impregnated with the fine volatile ſpirit, though all alike ſtrongly ſaturated with groſs particles.

15. Having found this nauſeous draught very uſeful againſt the ſmall-pox, to as many as could be prevailed on to take it; I began to conſider the nature of tar. I reflected that tar is a balſam flowing from

from the trunks of aged evergreens; that it reſiſts putrefaction; that it hath the virtues of turpentine, which in medicine are known to be very great and manifold; but I obſerved withal, that turpentines or balſams are very offenſive in the taking: I therefore conſidered diſtinctly the ſeveral conſtituent parts of balſams; which were thoſe, wherein the medicinal virtues reſided, and which were to be regarded, rather as a viſcous matrix to receive, arreſt, and retain the more volatile and active particles; and if theſe laſt could be ſo ſeparated and diſengaged from the groſſer parts, as to impregnate a clear and potable liquor, I concluded that ſuch liquor muſt prove a medicine of great force, and general uſe. I conſidered, that nature was the beſt chymiſt and preparer of medicines, and that the fragrance and flavour of tar argued very active qualities and virtues.

16. I had, of a long time, entertained an opinion, agreeable to the ſentiments of many ancient philoſophers, *that fire may be regarded as the animal ſpirit of this viſible world.* And it ſeemed to me that the attracting and ſecreting of this fire in the various pores, tubes, and ducts of vegetables, did impart their ſpecific virtues to each kind; that this ſame light, or fire, was the immediate inſtrumental or phyſical cauſe of ſenſe and motion, and conſequently of life and health to animals; that on account of this ſolar light or fire, *Phœbus* was in the ancient mythology reputed the god of medicine. Which light as it is leiſurely introduced, and fixed in the viſcid juice of old firs and pines, ſo the ſetting it free in part, that is, the changing its viſcid for a volatile vehicle, which may mix with water, and convey it throughout the habit copiouſly and inoffenſively, would be of infinite uſe in phyſic, extending to all caſes whatſoever, inaſmuch as all diſtempers are in effect a ſtruggle, between the *vis vitæ* and the peculiar miaſma or fomes morbi; and nothing ſtrengthens nature, or lends ſuch aid and vigour to life, as a cordial which doth not heat.

17. The

17. The ſolar light in great quantity during the ſpace of many ſucceſſive years, being attracted and detained in the juice of ancient evergreens, doth form and lodge itſelf in an oil ſo fine and volatile, as ſhall mix well with water, and lightly paſs the *primæ viæ*, and penetrate every part and capillary of the organical ſyſtem, when once exempt and freed from the groſſer nauſeous reſin. It will not, therefore, ſeem unreaſonable, to whoever is acquainted with the medicinal virtues of turpentine in ſo many different diſtempers, for which it hath been celebrated both by ancient and modern phyſicians, and withal reflects on the nauſea or clog that prevents their full operation and effect on the human body; it will not, I ſay, ſeem unreaſonable to ſuch a one to ſuppoſe, that if this ſame clog was removed, numberleſs cures might be wrought in a great variety of caſes.

18. The *deſideratum* was, how to ſeparate the active particles from the heavy viſcid ſubſtance which ſerved to attract and retain them, and ſo to order matters, that the vehicle of the ſpirit ſhould not on the one hand be volatile enough to eſcape, nor on the other, groſs enough to offend. For the performing of this, I have found a moſt eaſy, ſimple, and effectual method, which furniſheth a potable inoffenſive liquor, clear and fine as the beſt white wine, cordial and ſtomachic, to be kept bottled, as being endued with a very ſenſible ſpirit, though not fermented.

19. I tried many experiments as to the quantity of water, and the time of ſtirring and ſtanding, in order to impregnate and clarify it, and, after all, fixed on the forementioned receipt, as the moſt generally uſeful for making this ſalutiferous liquor well impregnated, and not offenſive to common ſtomachs, and even drank with pleaſure by many: in which the moſt medicinal and active particles, that is, the native ſalts and volatile oil of the balſam, being diſentangled and ſeparated from its groſs oil and viſcous reſin do, combined together, form a fine, balſamic and vegetable

vegetable ſoap, which not only can paſs the ſtomach and *primæ viæ* but alſo inſinuate itſelf into the minuteſt capillaries, and freely pervade the whole animal ſyſtem; and that, in ſuch full proportion and meaſure, as ſuiteth every caſe and conſtitution.

20. The foregoing general conſiderations put me upon making experiments in many various and unlike caſes, which otherwiſe I ſhould never have thought of doing, and the ſucceſs anſwered my hopes. Philoſophical principles led me to make ſafe trials, and on thoſe trials is founded my opinion of the ſalutary virtues of tar water; which virtues are recommended from, and depend on experiments and matters of fact, and neither ſtand nor fall with any theories or ſpeculative principles whatever. Howbeit, thoſe theories, as I ſaid, enlarged my views of this medicine, led me to a greater variety of trials, and thereby engendered and nouriſhed my ſuſpicion, that it is a panacea. I have been the more prolix in theſe particulars, hoping that, to as many as ſhall candidly weigh and conſider them, the high opinion I conceive of this medicine will not ſeem altogether an effect of vain prepoſſeſſion or blind empiric raſhneſs, but rather the reſult of free thought and inquiry, and grounded on my beſt reaſon, judgment, and experience. Much complaint is indeed made of the iniquity of the times. However, it is hoped they will not condemn one man's tar water for another's pill or drop, any more than they would hang one man for another's having ſtole a horſe.

21. Thoſe who have only the good of mankind at heart, will give this medicine fair play; if there be any who act from other motives, the public will look ſharp and beware. To do juſtice to tar water, as well as to thoſe who drink it, regard muſt be had to the particular ſtrength and caſe of the patients. Grievous or inveterate maladies muſt not be treated as common caſes. I cured a horrible caſe, a gangrene in the blood, which had broke out in ſeveral ſores, and threatened ſpeedy death,

death, by obliging the perſon to drink nothing but this liquor for ſeveral weeks, as much and as often as his ſtomach would bear. Common ſenſe will direct a proportionable conduct in other caſes. But this muſt be left to the conſcience and diſcretion of the givers and takers.

22. After all that can be ſaid, it is moſt certain, that a panacea ſounds odd, and conveys ſomewhat ſhocking to the ear and ſenſe of moſt men, who are wont to rank the univerſal medicine with the philoſophers ſtone, and the ſquaring of the circle; whereof the chief, if not ſole reaſon, I take to be, that it is thought incredible, the ſame thing ſhould produce contrary effects, as it muſt do if it cures oppoſite diſtempers. And yet this is no more than every day's experience verifies. Milk, for inſtance, makes ſome coſtive and others laxative: this regards the poſſibility of a panacea in general; as for tar water in particular, I do not ſay it is a panacea, I only ſuſpect it to be ſo. Time and trial will ſhew.

23. But I am moſt ſincerely perſwaded from what I have already ſeen and tried, that tar water may be drank with great ſafety and ſucceſs, for the cure or relief of moſt, if not all diſeaſes; of ulcers, itch, ſcald-heads, leproſy, the foul diſeaſe, and all foul caſes, ſcurvies of all kinds, diſorders of the lungs, ſtomach, and bowels, in rheumatic, gouty and nephritic ailments, megrims, inveterate head achs, pleuriſies, peripneumonies, eryſipelas, ſmall-pox and all kinds of fevers, colics, hyſteric and all nervous caſes, dropſies, decays, and other maladies. Note, that for agues it ſhould be drank warm, and often, in ſmall glaſſes, both in and out of the fit, and continued for ſeveral days to prevent a relapſe. Nor is it of uſe only in the cure of ſickneſs, it is alſo uſeful to preſerve health, and guard againſt infection, and in ſome meaſure even againſt old age, as it gives laſting ſpirits, and invigorates the blood. I am even induced by the nature and analogy of things, and its wonderful ſucceſs in fevers

fevers of all kinds, to think that tar water may be very uſeful againſt the plague, both as a preſervative and a cure.

24. But I doubt no medicine can withſtand that execrable plague of diſtilled ſpirits, which do all, without exception, (the fire of the hot ſtill imparting a cauſtic and coagulating quality to all diſtilled ſpirits, whatever the ſubject or ingredients may be) operate as a ſlow poiſon, preying on the vitals, and waſting the health and ſtrength of body and ſoul: which peſt of human kind is, I am told, gaining ground in this country, already too thin of inhabitants.

I am, &c.

FARTHER

THOUGHTS

ON

TAR WATER.

FARTHER

THOUGHTS, &c.

As the many experiments that are daily made of the virtues of tar water, furniſh new diſcoveries and reflections, ſome of theſe I have thrown together, and offer to the public in hopes they may prove uſeful.

It is a frequent complaint, that tar water is made of bad tar, being of a reddiſh colour, ſweetiſh, or diſagreeably inſipid. But though the dregs of tar are often foul, and make foul tar water, and though tar already uſed is often made uſe of by unfair dealers a ſecond, if not a third time, which produceth a vile potion, void of the genuine flavour and virtue of tar water. Yet I apprehend theſe defects may ſometimes be aſcribed, rather to the veſſel wherein the tar water is made, than to the tar itſelf.

Tar water being made in an earthen veſſel unglazed, or that hath loſt part of its glazing, may extract (as it is a ſtrong menſtruum) from the clay, a fade ſweetiſhneſs, offenſive to the palate. It ſhould ſeem therefore that the beſt way of making tar water is in a ſtone jug, or earthen veſſel throughout well glazed, and, as it will not fail to extract a tincture from any metallic veſſel, it ſhould be warmed in a well glazed pipkin, rather than a ſaucepan.

By

By increaſing the proportion of tar to the water, and by ſtirring it longer, tar water may be made ſtrong enough for a ſpoonful to impregnate a large glaſs, a thing very uſeful on a road.

Thoſe who in chronical diſorders, or as a preſervative, have for a long time drank tar water, muſt in acute caſes drink the more.

Tar water muſt be drank warm in agues, ſmall-pox, meaſles, and fevers, in colics and diſorders of the bowels, in gout alſo, and rheumatiſm, in moſt other ailments, cold or warm, at the choice of the patient.

In fevers the patient cannot begin too ſoon, or drink too much. By undoubted experience it is found to cool the hot, and warm the cold, and to be a moſt ſucceſsful medicine in fevers, notwithſtanding its great virtue in palſies and dropſies.

When not long ſince an inflammation attacked the throat, breaſt, and lungs of children, and became general in my neighbourhood, numbers were recovered by the uſe of tar water, nor did I hear that any miſcarried who uſed it, though many periſhed who did not.

Nor is it a medicine leſs proper and efficacious in old age. At the ſame time that this inflammatory diſtemper raged among the children, a woman in her ſixty-eighth year, from violent cold was ſeized at once with ague, colic, and jaundice, of all which maladies ſhe was cured in a fortnight, by drinking three pints of warm tar water every day. Numberleſs ſuch inſtances daily occur, which ſhew it to be a ſafe and efficacious medicine both for old and young.

Evacuations by ſweat, which uſually render patients very weak and diſpirited, have not the ſame bad effects when produced by tar water, which

which I have frequently known to give high ſpirits in all the ſtages of a fever, and under the loweſt regimen, therefore old people and weak perſons, who cannot well bear common evacuations, are beſt cured by tar water, which in ſome ſort ſeemeth to renew thoſe who are worn out with age and infirmities.

Tar water is of ſingular uſe in ſtrengthening the ſtomach and bowels, and agrees particularly well with infants, taken either by themſelves or by the nurſe, and beſt by both. Though as it throws the ill humours out into the ſurface of the ſkin, it may render them for a time, perhaps, unſeemly with eruptions, but withal healthy and lively. And I will venture to ſay, that it lays in them the principles of a good conſtitution for the reſt of their lives.

Nor is it only uſeful to the bodies of infants, it hath alſo a good effect on their minds, as thoſe who drink it are obſerved to be remarkably forward and ſprightly. Even the moſt heavy, lumpiſh, and unpromiſing infants, appear to be much improved by it. A child there is in my neighbourhood, of fine parts, who at firſt ſeemed ſtupid and an idiot, but, by conſtant uſe of tar water, grew lively and obſerving, and is now noted for underſtanding beyond others of the ſame age.

Infants are eaſily brought to take it by ſpoon, and even grow to a liking of it, and as their diſorders ariſe chiefly from indigeſtion, they receive the greateſt benefit from a medicine ſo well calculated to ſtrengthen the inteſtines, and preſerve them from fits. In a word, if it were the common practice to accuſtom infants from the beginning to take tar water, this would greatly conduce to the health both of their minds and bodies. There is, I am verily perſuaded, no one thing in the power of art or nature, that would ſo generally and effectually contribute to repair the conſtitutions of our gentry and nobility, by ſtrengthening the children,

dren, and caſting off in their infancy thoſe impurities and taints, which they often bring into the world.

An infant may take one quarter of a pint in the day, warm, by ſpoonfuls, leſs may do good, and there is no fear of exceſs. When I conſider the private woe of families, as well as the public loſs occaſioned by the death of ſuch an incredible number of infants, under two years of age, I cannot but inſiſt on recommending tar water, both as a remedy and preſervative in that tender age, which cannot bear the common treatment and methods of phyſic, or with ſafety take thoſe drugs which are fitter for grown perſons.

Another reaſon which recommends tar water, particularly to infants and children, is the great ſecurity it brings againſt the ſmall-pox, to thoſe that drink it, who are obſerved, either never to take that diſtemper, or to have it in the gentleſt manner.

There is no diſtemper more contagious and deſtructive than the ſmall-pox, or more generally dreaded, attended with worſe ſymptoms, or that leaves behind it worſe effects; I obſerve at the ſame time, that tar water is in no other caſe a more ſafe and ſure remedy than in this; of which captain *Drape*'s certificate, ſworn to before the mayor of *Liverpool*, in the preſence of ſeveral principal perſons of that town, is a moſt evident proof.

That one hundred and ſeventy perſons, ſeized at once with the ſmall-pox, deprived of all conveniencies, and in the worſt circumſtances of a narrow ſhip and hot climate, ſhould all recover by the ſingle medicine of tar water, except one who would not drink it, is a matter of fact, ſo plain and convincing, and ſo well atteſted, as to leave no doubt in minds free from prepoſſeſſion, about the uſefulneſs and efficacy of tar water in the

the ſmall-pox; a point I had been before ſufficiently convinced of, by many inſtances in my own neighbourhood.

It hath been ſurmiſed by ſome celebrated phyſicians, that one day a ſpecific may be diſcovered for the peculiar venom of the ſmall-pox. There ſeems to be ſome reaſon for thinking, that tar water is ſuch a ſpecific. I ſay this on good grounds, having by many experiments obſerved its virtue in curing, as well as in preventing, that cruel diſtemper; during the whole courſe of which, it is to be drank warm; a moderate glaſs (about half a pint) every hour, in common caſes, may ſuffice, in bad caſes more may be given; there is no fear of exceſs.

Thoſe who endeavour to diſcredit this cooling, cordial, and ſalutary medicine, as an inflamer of the blood, do very conſiſtently decry its uſe in the ſmall-pox, but there can be nothing more clear, full, and ſatisfactory than captain *Drape*'s affidavit, to convince reaſonable people of the great and ſurpriſing efficacy of tar water, in the cure of the ſmall-pox; and conſequently of the groundleſſneſs of that report, which aſcribes a heating or inflaming quality to it. And yet that groundleſs report hath hindered many from reaping the benefit they might otherwiſe have done, from the uſe of this water, which is of excellent virtue in all kinds of inflammatory diſorders, fevers, quinſies, pleuriſies, and ſuch like of the hot and inflamed kind, whereof the public as well as myſelf have known a multitude of examples.

I aſk whether the fact ſworn before the magiſtrates of *Liverpool*, be not a ſufficient anſwer, to all that is objected, from an inflaming quality, to tar water. Can any inſtance be produced in the whole *materia medica*, or hiſtory of phyſic, of the virtue of a medicine tried on greater numbers, or under greater diſadvantages, or with greater ſucceſs, or more credibly atteſted. I wiſh for the common good of mankind, that

the ſame experiment was tried in our hoſpitals. Probably the world would ſoon be relieved from that great and general terror of the ſmall-pox.

When I hear of the devaſtations made by this diſtemper, in great cities and populous towns, how many lives are loſt, or (as may be ſaid) thrown away, which might have been in all likelihood eaſily preſerved, by the uſe of a medicine, ſo cheap and obvious, and in every one's power, it ſeems matter of great concern and aſtoniſhment, and leaves one at a loſs to gueſs at the motives, that govern human actions in affairs of the greateſt moment. The experiment may be eaſily made, if an equal number of poor patients in the ſmall-pox, were put into two hoſpitals at the ſame time of the year, and provided with the ſame neceſſaries of diet and lodging, and, for further care, let the one have a tub of tar water and an old woman, the other hoſpital, what attendance and drugs you pleaſe.

In all obſtinate ſores and ulcers, I very much recommend the drinking of tar water, and waſhing them with a ſtrong lotion of it, will haſten the cure.

One of the moſt painful and dangerous caſes is that of a woman's ſore breaſt. How many poor creatures after long languiſhing in miſery, are obliged to ſuffer the moſt ſevere chirurgical operations, often the cutting off the entire breaſt? The uſe of tar water in thoſe caſes hath been attended with ſuch ſucceſs, that I do earneſtly recommend the drinking thereof, both as a cure and preſervative, as a moſt effectual medicine to remove the ſhooting pains that precede a cancer, and alſo to cure the cancer itſelf, without amputation. Cancerous and ſore breaſts are ſuch cruel caſes, occaſioned by ſo many internal cauſes, as well as outward accidents, that it is a neceſſary piece of humanity, to contribute all we can to the prevention and cure thereof.

In

In the king's evil, leproſy, and fouleſt caſes, tar water cannot be too much recommended. The poor vagabonds of *Ireland*, are many of them infected and eaten up with the foul diſeaſe, which with them paſſeth for a canker (as they call it). Several inſtances of extraordinary cures have been performed on ſuch perſons, by drinking tar water copiouſly, for ſome weeks or months together, without confinement or other reſtraint, than that of a regular cool diet. It is indeed a ſpecific, both for this and all other taints and impurities of the blood.

An extract of *Siris* was made, and accounts of the effects of tar water were reprinted in *America*, in which continent, as well as in the iſlands, much uſe hath been made thereof, particularly by thoſe who poſſeſs great numbers of ſlaves; of this I have been informed by letters, and by word of mouth, from perſons belonging to thoſe parts, who have aſſured me of the extenſive and ſucceſsful uſe of this medicine in many caſes, and more eſpecially in the moſt inveterate kinds of the foul diſeaſe.

I need not ſay how dearly they purchaſe health who obtain it by ſalivation, and yet long and ſevere as that courſe is, it is often unſucceſsful. There are inſtances of ſuch as having paſſed through it with much miſery and patience, have been afterwards cured by the ſimple uſe of tar water.

The king's evil, ſo loathſome in its ſymptoms and effects, and withal ſo difficult, if at all poſſible, to cure by any other method, is moſt ſurely and eaſily cured by the tar water, even when the patient is far gone, even when he derives it from his anceſtors. A quart *per diem* for a few months, I have known to cure the moſt deplorable and abandoned caſes.

How many wealthy families, otherwiſe at their eaſe, are corrupted with this taint in their blood? How many want heirs and huſbands,

through this odious malady? A ſpecific for this diſeaſe alone, would be juſtly eſteemed a moſt valuable ſecret, and the plenty and cheapneſs of the medicine ought not in reaſon, to make it leſs eſteemed.

Salivating, bleeding, and purging, are attended with great hardſhips and inconveniencies (even where the patient recovers) reducing the ſtrength and ſpirits of thoſe who uſe them, whereas tar water greatly adds to both.

In fractures and wounds, a quart or two drank daily, while the patient is under cure, doth very much aſſuage the pain and promote his recovery, both as by its balſamic nature it diſpoſeth the parts to heal, and alſo as it leſſens if not totally prevents the fever.

A poor boy in *Cloyne*, having fallen from a tree, broke both arm and wriſt. This accident was concealed or neglected for two or three weeks, he was then put under the care of a ſkilful bone-ſetter, who finding the bones knit and grown crooked, and that it would be neceſſary to break them again, in order to ſet them right, and withal conſidering the hot ſeaſon of the year (in *July*) he apprehended, his patient's being thrown into a fever that might prove fatal. But the boy being made to drink copiouſly of tar water, this prevented or leſſened the fever in ſuch ſort, that the bones were broke and ſet again, and the cure proceeded as eaſily and ſpeedily as could be wiſhed.

I have known ſeveral inſtances of bruiſes and wounds cured by tar water. A perſon in my neighbourhood ran over by a horſe was much bruiſed, and cured only by drinking tar water. Another knocked down with a mallet, thereupon thrown into a violent fever, and given for dead; another wounded with an axe, ſo that his life was thought in danger, were both recovered by the uſe of tar water; which, as it is ſovereign againſt gangrenes

gangrenes and fevers, hath great ſucceſs in all ſorts of wounds, contuſions, and fractures, being taken throughout the whole chirurgical proceſs, along with whatſoever other methods or remedies are applied.

Tar water operates variouſly. In dropſies and bruiſes it hath been known to work by purging. The ſtronger kind being uſed as a waſh, is good againſt ulcerous eruptions. But in all caſes where the lotion is uſed, I believe the drinking of tar water might alone ſuffice, albeit the ſores may be longer withering and drying away.

There is a certain age or time of life, when the female ſex runs no ſmall riſk from the ceaſing of their natural evacuations. In this caſe tar water is a good preſervative, purifying the blood, and clearing it from that cancerous tendency, which it is ſometimes ſubject to, about that time. I take it to be a ſpecific in all cancerous caſes, even the bleeding cancer, eſteemed incurable by phyſicians, hath been cured by tar water.

In diſeaſes peculiar to women it is of no ſmall uſe. Several who had ſuffered much by accidents in child-bearing, have found themſelves relieved by tar water. In all ſorts of tumours, wens, and preternatural excreſcences, it hath been found an excellent remedy.

Many dangerous ſymptoms, and even ſudden death are often owing to a polypus, in ſome or other of the veſſels, through which the blood circulates, than which it ſeems there is no inward cauſe of death or diſeaſe more to be dreaded and guarded againſt; how many drop down dead in our ſtreets, or at table, or in the midſt of buſineſs or diverſions? how many are found dead in their beds?

Tremors,

Tremors, palpitations of the heart, irregular pulſes, apoplexies, ſudden deaths, often proceed from a ſlow, ſtagnating, interrupted motion, or ſtoppage of the blood, in its circulation through the body; and there ſeemeth to be no cauſe ſo certainly productive of obſtructed circulation as the polypus, a caſe, perhaps, much more frequent than is commonly imagined. *Morgagni*, the celebrated profeſſor at *Padua*, and moſt eminent anatomiſt, who was ſuppoſed to have diſſected more human bodies than any man living, aſſured me, above thirty years ago, that in the far greater part of ſuch bodies, he found polypuſes, if not in the ventricles of the heart or larger veſſels, yet in ſome other veſſel or cavity; to which he attributes many diſorders, and which he ſuppoſed to be formed by the obſtructed motion of the blood. To prevent this he diſſuaded from all tight ligatures, eſpecially in ſleep, unbuttoning the neck and wriſt bands of his ſhirt every night, a practice he had learned (as he ſaid) from his maſter, the famous *Malpighi*.

When the circulation is once quite ſtopped, nothing can reſtore it, which would be the ſame thing as reſtoring a dead man to life, and in proportion as the circulation of the blood is obſtructed, the body is diſordered. Total obſtruction is death; partial obſtruction is diſeaſe. The polypus therefore is always hurtful, if not mortal. It is, indeed, matter of ſerious reflexion, that we may probably carry about with us a principle of death, always at work within, and of a nature ſo violent and ſudden in its effects, ſo hard to come at, and ſo difficult to ſubdue.

It may well be thought at firſt view, a vain undertaking, to attempt to diſſolve a fleſhy or membranous ſubſtance, ſo latent and inacceſſible, by common means or medicines. But, as tar water hath been undoubtedly known to diſſolve and diſperſe wens, and other fleſhy or membranous tumours, in the outward parts of the body *, having been drank

* See the effects of tar water, Sect. 228, and 229.

and

and circulated with the blood, it ſhould ſeem by a parity of reaſon, that it may alſo diſſolve and put an end to thoſe concretions that are formed in the ventricles of the heart or blood veſſels, and ſo remove one great cauſe of apoplexies and ſudden death; and what cures may prevent. I have been the longer on this ſubject, for the ſake of many who lead ſickly lives, as well as ſeveral who are ſnatched away by untimely death.

Univerſally, in all caſes where other methods fail, I could wiſh this of tar water was tried. It hath been ſometimes known, that the moſt inveterate head-achs, and other nervous diſorders, that would yield to no other medicine, have been cured by a courſe of tar water, regularly and conſtantly purſued.

Whereſoever pure blood or plenty of ſpirits are wanting, it may be concluded from manifold experience, that tar water is of ſingular benefit. Several perſons have acknowledged themſelves to be much fitter to go through buſineſs or ſtudy from the uſe of it.

Nor is it only medicinal to human kind: it is alſo of no ſmall uſe in the curing of brute animals. It hath been tried on ſeveral kinds, particularly with great ſucceſs in the late epidemical diſtemper of our horſes. And I have been credibly informed, that being drank in plenty, it hath recovered even a glandered horſe, that was thought incurable.

And as it is of ſuch extenſive uſe, both to man and beaſt, it ſhould ſeem, that a tub of tar water conſtantly ſupplied in a market town, would ſerve, in ſome ſort, for an hoſpital. Many other drugs are not eaſily got, this is every where plenty and cheap; many are of a doubtful nature, this of known innocence; others ſoon periſh, this laſts for years, and is not the worſe for keeping. This, in ſhort, is a medicine for the com-

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mon people, being a ſafe and cheap remedy, for ſuch as cannot afford to be long ſick, or to make uſe of coſtly medicines.

A patient who drinks tar water, muſt not be alarmed at puſtules or eruptions in the ſkin; theſe are good ſymptoms, and ſhew the impurities of the blood to be caſt out. It is alſo not amiſs to obſerve, that, as tar water, by its active qualities doth ſtir the humours, entering the minuteſt capillaries, and diſlodging obſtructions, it may happen that this working ſhall ſometimes be felt in the limbs, or diſcharge itſelf in a fit of the gout, which however diſagreeable, proves ſalutary.

I am credibly informed of ſeveral ſtrange conveyances, which tar water hath found out, whereby to diſcharge impurities from the human conſtitution. A perſon who had been in a bad ſtate of health above twenty years, upon a courſe of tar water was thrown into a moſt extraordinary fit of an ague, and from that time recovered a good ſtate of health. An old gentleman in the county of *Cork*, who for a long time had been a valetudinarian, afflicted with many infirmities, being adviſed to drink tar water, found himſelf relieved, but it produced and ſoon cured a pthiriaſis or louſy diſtemper, in which the putrid humours having diſcharged themſelves, left him quite ſound and healthy.

In a courſe of tar water, if any diſorder happens from ſome other cauſe, as from cold, from the uſe of ſtrong liquors, from a ſurfeit, or ſuch like accident, it would not be fair to impute it to tar water; and yet this hath been ſometimes done.

The effects of vomiting occaſioned by tar water are not to be apprehended. Some are diſcouraged from drinking becauſe their ſtomachs cannot

A SECOND

LETTER to T----- P----, Eſq;

1. YOUR attention to whatever promotes the public good of your country, or the common benefit of mankind, having engaged you in a particular enquiry concerning the virtues and effects of tar water, you are entitled to know, what farther diſcoveries, obſervations and reflections I have made on the ſubject.

2. Tar water, in the ſeveral editions of *Siris*, hath been directed to be made by ſtirring three, four, five or ſix minutes, a gallon of water, and a quart of tar. But although it ſeem beſt made, for general uſe, within thoſe limits, yet the ſtomach of the patient is the beſt rule, whereby to direct the ſtrength of the water; with a little more ſtirring, ſix quarts of good tar water may be made from one of tar; and with eight minutes ſtirring, I have known a gallon of tar water produced from ſecond-hand tar, which proved a good remedy in a very bad fever, when better tar could not be had. For the uſe of travellers, a tar water may be made very ſtrong, for inſtance, with one quart of water, and a quart of tar, ſtirred together for the ſpace of five minutes. A bottle of this may ſerve long on a road, a little being put to each glaſs of common water, more or leſs, as you would have it ſtronger or weaker. Near two years ago, a quart of about this ſtrength was given to an old woman, to be taken at one draught by direction of a young lady, who had conſulted

one in my family, about the method of preparing and giving tar water, which yet ſhe happened to miſtake. But even thus, it did ſervice in the main, though it wrought the patient violently all manner of ways: which ſhews, that errors and exceſſes in tar water, are not ſo dangerous, as in other medicines.

3. The beſt tar I take to be that, which is moſt liquid, or firſt running from the billets of fir or pine, which grew on the mountains: it hath a greater ſhare of the antiſcorbutic vegetable juices, which are contained not only in the leaves and tender tops, but in all parts of the wood; and theſe, together with the ſalts of woodſoap, being in the compoſition of tar ſuperadded to turpentine, render tar water a medicine, if I am not miſtaken, much more extenſive and efficacious, than any that can be obtained from turpentine alone.

4. The virtues of the wood juices ſhew themſelves in ſpruce-beer, made of molaſſes, and the black ſpruce-fir in the northern parts of *America*; and the young ſhoots of our common ſpruce-fir have been put to malt liquor in my own family, and make a very wholeſome drink.

5. Tar water ſeldom fails to cure, or relieve, when rightly made of good tar, and duly taken. I ſay, of good tar, becauſe the vile practice of adulterating tar, and of ſelling the dregs of tar, or uſed tar for freſh, is grown frequent, to the great wrong of thoſe who take it. Whoever hath been uſed to good tar water, can readily diſcern the bad by its flat taſte, void of that warm cordial quality found in the former; it may alſo be expedient for knowing freſh tar, to obſerve, whether a fat oily ſcum floats on the top of the water, which is found to be much leſs, if any at all, on the ſecond making of tar water. This ſcum was directed to be taken out, not from its being apt to do harm when drank, but to render the tar water more palatable to nice ſtomachs. Great quantities of tar

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are produced in *Germany*, *Italy*, and other parts of the world. The different qualities or virtues of theſe, it may be worth while to try, and I wiſh the trial were made principally by obſerving, which giveth moſt ſenſe of a lively cordial ſpirit upon drinking the water.

6. This medicine of tar water worketh various ways, by urine, by perſpiration, as a ſudorific, carminative, cardiac, aſtringent, detergent, reſtorative, alterative, and ſometimes as a gentle purgative or emetic, according to the caſe or conſtitution of the patient, or to the quantity that is taken; and its operation ſhould not be diſturbed. I knew two brothers ill of a fever about the ſame time; it wrought on the one by copious ſweating, on the other altogether by urine; and I have known it to act at different times differently, even on the ſame perſon, and in the ſame diſorder; one while as a diaphoretic, or ſudorific, another as a diuretic. Its general character is diuretic, which ſhews, that it cleanſeth the urinary paſſages, preventing thereby both ſtone and gravel, againſt which it hath been found very uſeful, and much ſafer than mineral waters, by reaſon of its balſamic healing quality.

7. Tar water doth recover and impart vital heat, but imparts no inflaming heat. I have ſeen a wonderful cure wrought on a child about eight years old, and paſt all hopes, by pouring ſeveral ſpoonfuls of tar water down his throat, as he lay quite ſubdued by a moſt violent fever, without any appearance of ſenſe or motion, the noſtrils drawn back, the eyes fixed, the complexion deadly wan. And yet tar water, forced down by ſpoonfuls, ſeemed to kindle up life a-new; and this after ſage-tea, ſaffron, milk-water, Venice treacle, &c. had been uſed without any ſucceſs.

8. This is of itſelf a ſufficient cordial, friendly and congenial to the vital heat and ſpirits of a man. If therefore ſtrong liquors are in the accuſtomed quantity ſuperadded, the blood being already, by tar water, ſufficiently

ſufficiently warmed for vital heat, the ſtrong liquors ſuperadded will be apt to over-heat it, which over-heating is not to be imputed to the tar water, ſince, taken alone, I could never obſerve it attended with that ſymptom.

9 And though it may be no eaſy matter to perſuade ſuch as have long indulged themſelves in the free uſe of ſtrong fermented liquors and diſtilled ſpirits, to forſake their pernicious habits, yet I am myſelf thoroughly perſuaded, that in weakneſs or fatigue of body, or in low ſpirits, tar-water alone doth far ſurpaſs all thoſe vulgarly eſteemed cordials, which heat and intoxicate, and which coagulate the fluids, and, by their cauſtic force, dry up, ſtiffen, and deſtroy the fine veſſels and fibres of the unhappy drinkers, obſtructing the ſecretions, impairing the animal functions, producing various diſorders, and bringing on the untimely ſymptoms of old age. Nothing doth ſo much obſtruct the good effects of tar water, as the abuſe of ſtrong liquors. Where this is avoided, it ſeems no chronical malady can keep its ground, or ſtand before tar water conſtantly and regularly taken, not even hereditary diſtempers, as the moſt inveterate king's-evil, nor even the moſt confirmed gout; provided it be drank a quart a day, at ſix or eight glaſſes, and at all ſeaſons, both in and out of the fit, and that for a great length of time, the longer the better. It is to be noted, that in fits of the gout, colic, or fever, it ſhould be always drank warm. On other occaſions, warm or cold, as the patient likes.

10. The inference I make is, that thoſe who expect health from tar water, have leſs need of any other cordial, and would do well to ſacrifice ſome part of their pleaſure to their health. At the ſame time I will venture to affirm, that a fever produced either from hard drinking, or any other cauſe, is moſt effectually and ſpeedily ſubdued, by abſtaining from all other cordials, and plentifully drinking of tar water; for it warms the cold, and cools the hot; ſimple water may cool, but this, at the

the ſame time that it cools, gives life and ſpirit. It is, in truth, a ſpecific for all kinds of fevers; the ſame medicine, which is a leiſurely alterative in chronical diſorders, being taken in larger quantities, is a ſpeedy cure in acute ones.

11. Thoſe who, without knowledge or experience of tar water, have been ſo active and earneſt to diſcredit its virtues, have much to anſwer for, eſpecially with regard to acute inflammatory diſtempers, in which it doth wonders. It is in thoſe diſorders, ſo fatal and frequent, that I have had moſt opportunities of obſerving its virtues, nor can the world ever know the juſt value of this medicine, but by trying it in the like caſes.

12. When patients are given over, and all known methods fail, it is allowed to try new remedies. If tar water was tried in ſuch caſes, I do verily believe, that many patients might thereby be reſcued from the jaws of death: particularly, I would recommend the trial of it, in the moſt malignant and deſperate fevers or ſmall-pox, attended with purple, livid, or black ſpots. It is my ſincere opinion, that warm tar water, drank copiouſly, may often prove ſalutary, even in thoſe deplorable caſes.

13. My opinion is grounded on its ſingular virtues in correcting, ſweetening, and invigorating the blood, and in curing cancers and gangrenes, or beginning mortifications, ſuch as thoſe ſpots do indicate. I have lately known it drunk with good ſucceſs in a very painful and unpromiſing wound; and am perſuaded, that if it were drank plentifully, during the dreſſing of all ſorts of dangerous wounds, it might aſſuage the anguiſh, and forward the cure; as it abates feveriſh ſymptoms, and by rendering the blood balſamic, and diſpoſing the parts to heal, prevents a gangrene.

14. Tar

14. Tar itſelf is an excellent medicine, being ſpread on a cloth, and applied warm to an ulcer or wound. I have known the ſame applied to a very large and painful tumour, cauſed by a ſprain or bruiſe, ſpeedily aſſuage the pain, and reduce the ſwelling. I may add, that tar (mixed with honey to make it leſs offenſive, and) taken inwardly, is an admirable balſam for the lungs; and a little of this, taken together with tar water, haſtens its effect in curing the moſt obſtinate and waſting coughs; and an egg-ſhell full of tar, ſwallowed and waſhed down with a quart of tar water, night and morning, hath been found very uſeful for the ſame diſorder in horſes.

15. Sitting over the vapour of the heated lotion, deſcribed in my former letter, is excellent in the caſe of piles or fiſtula; eſpecially if fomenting with the ſame lotion be added, as alſo anointing with the oil ſcummed from the top of tar water. Tar water hath been ſnuffed up the noſtrils, with good ſucceſs, for a great heavineſs of the head and drowſineſs. It is a very uſeful waſh for weak, dry, or itching eyes; an excellent preſervative for the teeth and gums; alſo a good drink and gargle for a ſore throat: I may add, that I have known it ſucceed in caſes where it has been tried without hopes of ſucceſs, particularly in deafneſs. I have known life ſuſtained many days together, only by drinking of tar water, without any other nouriſhment, and without any remarkable diminution of ſtrength and ſpirit; it may therefore be of ſingular uſe, and ſave many lives in the diſtreſs of famine at ſea, or in ſieges, and in ſeaſons of great ſcarcity. The virtue of tar water flowing like the *Nile* *, from a ſecret and occult courſe, brancheth into innumerable channels, conveying health and relief, wherever it is applied; nor is it more eaſy and various in its uſe, than copious in quantity. How great havock,

* The *Nile* was by the ancient *Ægyptians* called *Siris*, which word alſo ſignifies, in *Greek*, a chain, though not ſo commonly uſed as *Sira*.

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nevertheleſs, is made by the ſmall-pox, raging like a plague, in *New England*, and other parts of *America*, which yet abound with tar! and how many thouſand ſailors, in all parts of the world, are rotting by the ſcurvy with their remedy at hand!

16. Many in this town of *Cloyne* have, by the copious drinking of tar water alone been recovered of the moſt violent fevers, attended with the moſt threatening ſymptoms, and much heightened by relapſes from miſmanagement. It would be tedious to enumerate all the caſes of this kind, which have happened at *Cloyne*, and in my own family; where many fevers, pleuritic, as well as others, attended with violent ſtitches, difficulty of breathing, and ſpitting of blood, have been cured by tar water; and this I can with truth affirm, that I never knew it regularly tried, in any inflammatory caſe, without ſucceſs: but then it muſt be given in bed warm, and very copiouſly, with all due caution againſt cold, noiſe, and improper diet.

17. I have often obſerved, when a patient, on the firſt attack of a fever, hath betaken himſelf to his bed, and drank tar water regularly and conſtantly, that he hath had ſuch favourable ſymptoms, ſo good appetite, and ſo ſound ſleep, that the fever paſſed almoſt as nothing; nor was to be diſtinguiſhed otherwiſe, than by a quickneſs of pulſe, a little feveriſh heat, and thirſt. The more that patients in a fever drink, the better they find themſelves; and their liking to tar water grows with their want of it, by a certain inſtinct or dictate of nature; inſomuch that I have known children in very high fevers, who, at other times, could hardly be prevailed on to drink a ſingle glaſs, drink ſix or eight in an hour.

18. I can truly affirm that for the caſes within my own obſervation, inflammatory acute diſtempers cured by tar water, have been, at leaſt, ten times the number of any other. Theſe indeed oftener occur, as

cauſing

cauſing the chief deſtruction and general ravage of mankind; who are conſequently debarred from the principal uſe and benefit of this medicine ſo long, as they give ear to the ſuggeſtions of thoſe, who, without any experience thereof, would perſuade them, it is of an heating or inflaming nature; which ſuggeſtion, as I am convinced myſelf, by long and manifold experience, that it is abſolutely falſe, ſo may all others alſo be ſufficiently convinced of its falſhood, by the wonderful fact atteſted by a ſolemn affidavit of Captain *Drape*, at *Liverpool*; whereby it appears, that of 170 negroes ſeized at once by the ſmall-pox on the coaſt of *Guinea*, one only died, who refuſed to drink tar water; and the remaining 169, all recovered by drinking it, without any other medicine, notwithſtanding the heat of the climate, and the incommodities of the veſſel. A fact ſo well vouched muſt, with all unbiaſſed men, outweigh the poſitive aſſertions of thoſe, who have declared themſelves adverſaries of tar water, on the ſcore of its pretended heating or inflaming quality.

19. The ſkill and learning of thoſe gentlemen, in their profeſſion, I ſhall not diſpute; but yet it ſeems ſtrange, that they ſhould without experience pronounce at once, concerning the virtues of tar water, and aſcribe to it pernicious qualities, which I, who had watched its workings and effects for years together, could never diſcover. Theſe three laſt years, I have taken it myſelf without one day's intermiſſion; others in my family have taken it near the ſame time, and thoſe of different ages and ſexes; ſeveral in the neighbourhood have done as much, all without any injury, and with much benefit.

20. It is to be noted, the ſkin and the belly are antagoniſts; that is, the more paſſeth by perſpiration, the leſs will paſs another way. Medicines therefore, which cauſe the patient to perſpire, will be apt to make him coſtive. Therefore, when tar water worketh much by perſpiration, the body may chance to be bound. But ſuch ſymptom, though it ſhould

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be attended with a little more than ordinary warmth, need not be dreaded by the patient; it being only a ſign, that his cure is carried on by driving the peccant matter through the ſkin; which is one of the ways, whereby tar water worketh its effect. And when this effect or cure is wrought, the body of itſelf returneth to its former natural ſtate; and if ſome have been bound in their bodies, I have known others affected in a contrary manner upon drinking tar water, as it hath happened to operate either in the ſhape of a diaphoretic, or of a gentle opening medicine. I have even known a coſtive habit more than once removed by it, and that, when the caſe was inveterate, and other methods had failed.

21. I mentioned the foregoing article, upon calling to mind, that two or three patients had, for a time, complained of a binding quality in tar water. I likewiſe remember that one in a high degree of the ſcurvy was diſcouraged from the uſe of tar water, by its having cauſed an uneaſy itching all over his body. But this was a good ſymptom, which ſhewed the peccant humours to be put in motion, and in a fair way of being diſcharged through the ſkin.

22. An humour or flatus put in motion, and diſlodged from one part, often produceth new pains in ſome other part; and an efficacious medicine, as it produceth a change in the œconomy, may be attended with ſome uneaſineſs, which yet is not to be accounted a diſtemper, but only an effect or ſymptom of the cure.

23. The ſalts of tar water have nothing of the fiery and corroſive nature of lixivial ſalts produced by the incineration of the ſubject; they not being fixed ſalts, made by the extreme force of fire, but volatile ſalts, ſuch as pre-exiſted in the vegetable, and would have aſcended in ſmoke, if not prevented by the ſods or covering of the billet piles. This though

already hinted in *Siris*, and plain from the manner of making tar, I have thought fit to repeat and inculcate, becauſe, if duly attended to, it may obviate ſuſpicions about tar water, proceeding only from an ignorance of its nature.

24. Every ſtep that I advanced in diſcovering the virtues of tar water, my own wonder and ſurpriſe increaſed, as much as theirs to whom I mentioned them: nor could I without great variety and evidence of facts, ever have been induced to ſuſpect, that, in all ſorts of ailments whatſoever, it might relieve or cure, which at firſt ſight may ſeem incredible and unaccountable; but on maturer thought, will perhaps appear to agree with, and follow from the nature of things. For it is to be noted; that the general notion of a diſeaſe ſeemeth to conſiſt in this, that what is taken in, is not duly aſſimilated by the force of the animal œconomy; therefore it ſhould ſeem whatever aſſiſts the *vis vitæ* may be of general uſe in all diſeaſes, enabling nature either to aſſimilate, or diſcharge all unſubdued humours and particles whatſoever. But the light or æther detained on the volatile oil, which impregnates tar water, being of the ſame nature with the animal ſpirit, is an acceſſion of ſo much ſtrength to the conſtitution, which it aſſiſts to aſſimilate or expel whatever is alien or noxious.

A

LETTER

TO

T----- P----, Eſq;

CONCERNING

The Uſefulneſs of Tar Water in the PLAGUE.

Wherein alſo it is conſidered,

Whether Tar Water prepared with the diſtilled Acid of Tar ſhould be preferred, to that made in the common Way, by mixing Tar with Water, and ſtirring them together.

A

LETTER to T----- P----, Eſq; &c.

YOU obſerve in a late letter of yours, that I had formerly hinted, tar water might be uſeful in the plague, and deſire to know the reaſons whereon my opinion was grounded, and that I would communicate my thoughts at large on the ſubject; I am the more willing to ſatisfy you in this particular, as the plague now raging in *Barbary* hath in ſome meaſure alarmed the public, and I think it may not be amiſs to contribute my mite of advice towards averting or leſſening the preſent danger; and, as fear begets caution, to poſſeſs my countrymen with an apprehenſion of this the greateſt of all temporal calamities, ſufficient to put them on their guard, and prepare them againſt the worſt that can happen.

A learned phyſician of our own obſerves, that the plague does not viſit theſe Britannic iſlands oftener than once in thirty or forty years, and it is now above twice that time ſince we felt the hand of the deſtroying angel.

It is alſo the opinion of phyſicians, that the infection cannot ſpread, except there is a ſuitable diſpoſition in the air to receive it; the ſigns of which are wet ſummers, leaves and fruits blaſted, an unuſual quantity of inſects, epidemical diſtempers among the cattle, to which I preſume

may

may be added long eaſterly winds, all which ſigns ſeem to have diſcovered themſelves pretty plainly in the courſe of this preſent year.

Beſide theſe natural forerunners of a plague or peſtilence in the air, it is worth obſerving, that a prognoſtic may be alſo made from the moral and religious diſpoſition of the inhabitants. Certainly that the *digitus dei* (the τὸ θεῖον of *Hippocrates*) doth manifeſt itſelf in the plague, was not only the opinion of mankind in general, but alſo in particular of the moſt eminent phyſicians throughout all ages down to our own. How far we of theſe iſlands have reaſon to expect this meſſenger of divine vengeance, will beſt appear if we take a view of the prevailing principles and practices of our times, which many think have long called aloud for puniſhment or amendment.

Analogy and probability prevail in medicine: theſe are the proper guides where experience hath not gone before. I knew that tar water was uſeful to prevent catching the ſmall-pox, and conſequently that its nature was contrary to the taint or venom producing that diſtemper, and therefore I concluded, that it might be uſefully applied to cure the ſame, though I never heard nor knew that it had been applied to that purpoſe, and the ſucceſs anſwered my hopes.

In like manner, having known the virtue of tar water in preſerving from epidemical infection, I conceive in general it may be uſeful for the cure of diſtempers cauſed by ſuch infection. Beſides, being very well aſſured that tar water was ſovereign in the cure of all ſorts of fevers, I think it not unreaſonable to infer, that it may prove a ſucceſsful medicine for the plague, although I have never known it uſed in that diſtemper, foraſmuch as the plague with all its ſymptoms may be conſidered as a ſpecies of fever, and hath been actually conſidered as ſuch both by *Hippocrates* and *Sydenham*, not to mention others.

Having

Having obſerved ſurpriſing effects of tar water in the moſt deplorable caſes, for inſtance, pleuriſies, ſmall-pox, ſpotted and eryſipelatous fevers, I am induced to entertain great hopes of its ſucceſs in peſtilential fevers or plagues; which are alſo confirmed, by its operating as a powerful diaphoretic and ſudorific, when given warm and in great quantities. Add to this, that it frequently throws out poſtules and ulcers, and is apt to terminate the worſt of fevers by an irruption of boils in various parts of the body; that it raiſes the ſpirits, is a great alexipharmacum and cordial, and muſt therefore be of the greateſt uſe in malignant caſes.

In cachexy, ſcurvy, gout, as well as in the cloſe of fevers, I have often known tar water cauſe troubleſome eruptions or boils (the very method taken by nature in caſting forth the venom of the plague) to break out in the ſurface of the body, expelling the morbific humours, the cauſe and reliques of the diſeaſe, to the ſignal benefit of the patients; except ſuch who, being frightened at the ſymptoms, have ſuppoſed the tar water to produce thoſe humours which it only drives out, and in conſequence of ſuch their groundleſs ſuſpicion, laid it aſide, or perhaps took other medicines to hinder its effect, and thereby deprived themſelves of the benefit they might otherwiſe have received.

In the plague are obſerved head-ach, drowſineſs, anxiety, vigils, ſinking of ſpirits, and weakneſs, for all which tar water hath been found an effectual remedy. Bloody urine and ſpitting blood, which are alſo dangerous ſymptoms obſerved in the plague, have been often removed by the ſame medicine, which from numberleſs experiments I have found to be peculiarly fitted for purifying and ſtrengthening the blood, and for giving it a due conſiſtence, as well as a proper motion.

In

In the plague, pleuriſies are eſteemed mortal ſymptoms, and in the cure of theſe, I never knew tar water fail, if given warm in bed, a pint or more an hour, though the patient was neither bled nor bliſtered. The carbuncles and ſpots which ſhew themſelves in the plague are of a gangrenous nature, tending to mortification. And gangrenes I have known effectually cured by copious drinking of tar water.

An eryſipelas, which ſheweth a degree of malignity neareſt to the plague, is eaſily cured by plentiful drinking of tar water. I knew a perſon, who had been ſix weeks ill of an eryſipelas under the care of a celebrated phyſician, during which time ſhe ſtruggled with many dangerous ſymptoms, and hardly eſcaped with life. This perſon was a year after ſeized again in the ſame manner, and recovered in a week, by the ſole uſe of tar water. Coſtiveneſs is reckoned a very hopeful prognoſtic in the plague; and it is alſo a ſymptom which often attends the drinking of tar water, when it throws out the venom of a diſtemper thorough the ſkin.

Diſeaſes of the ſame ſeaſon generally bear ſome affinity to each other in their nature and their cure; and it may not be improper on this occaſion to obſerve, that the reigning diſtemper of the black cattle hath been often cured by tar water, and would (I am perſuaded) have done much leſs miſchief, if the practice had been general, to have given each diſtempered beaſt three gallons the firſt, two the ſecond, and one the third day, in warm doſes, (from a pint to a quart) and at equal intervals.

Diemerbroeck recommends in the firſt appearance of a plague the uſe of ſudorifics, putting the patient to bed, and covering him warm, till a copious ſweat be raiſed, the very method I conſtantly follow in the beginning of fevers, uſing no other medicine than tar water, which, after numberleſs experiments, I take to be the beſt ſudorific that is known, inaſmuch

inaſmuch as it throws out the morbific *miaſma*, without either heating the patient or weakening him, the common effects of other ſudorifics, whereas this, at the ſame time that it allays the feveriſh heat, proves a moſt ſalutary cordial, giving great and laſting ſpirits.

Upon the whole, I am ſincerely perſuaded, that for cure of the plague there cannot be a better method followed, more general for uſe, more eaſy in practice, and more ſure in effect, than to cover the patient warm in bed, and to make him drink every hour one quart of warm tar water, of ſuch ſtrength as his ſtomach is able to bear; a thing not ſo impracticable as it may ſeem at firſt ſight, ſince I have known much more drank in fevers even by children, and that eagerly and by choice, the diſtemper calling for drink, and the eaſe it gave encouraging to go on. This for the cure; but I conceive that one quart *per diem*, may ſuffice for prevention; eſpecially if there be added an even temper of mind, and an exact regimen, which are both highly uſeful againſt the plague. For carbuncles and buboes I would recommend a liniment of the oil of tar, or a plaiſter of pitch mixed with tar, which laſt was uſed by the vulgar in the *Dutch* plague deſcribed by *Diemerbroeck*.

It has pleaſed divine providence to viſit us not long ſince, firſt, with famine, then with the ſword; and if it ſhall pleaſe the ſame good providence yet further to viſit us for our ſins, with the third and greateſt of human woes, this, by God's bleſſing, is the courſe I mean to take for myſelf and family; and if generally practiſed, it would, I doubt not, (under God) ſave the lives of many thouſands; whereof being perſuaded in my own mind, both from the many trials I have made of tar water, and the beſt judgment and reaſonings I could form thereupon, I think myſelf obliged to declare to the world what I am convinced of myſelf.

And I am the rather moved to this by the great uncertainty and diſagreement among phyſicians, in their methods of treating the plague. *Diemerbroeck*, for inſtance, a phyſician of great experience in the *Dutch* plague, that raged about eighty years ago, diſſuades by all means from bleeding in that diſtemper. On the other hand, *Sydenham* recommends what the other diſapproves. If we believe Dr. *Sydenham*, the free uſe of wine, as a preſervative, hath thrown many into the plague, who otherwiſe might have eſcaped. Dr. *Willis* on the contrary avers, that he knew many, who being well fortified by wine, freely entered amongſt the infected, without catching the infection.

Bleeding cools, but at the ſame time weakens nature. Wine gives ſpirits, but heats withal. They are both therefore to be ſuſpected, whereas tar water cools without weakening, and gives ſpirits without heating, a ſure indication of its ſovereign virtue in all inflammatory and malignant caſes, which is confirmed by ſuch numbers of inſtances, that matter of fact keeps pace (at leaſt) with reaſon and argument in recommending this medicine.

Plagues as well as fevers are obſerved to be of different kinds; and it is obſerved of fevers, that, as they change their genius in different ſeaſons, ſo they muſt be treated differently, that very method that ſucceeded in one ſeaſon often proving hurtful in another. Now it is very remarkable, that tar water has been known to vary its working, and wonderfully adapt itſelf to the particular caſe of the patient, a thing I frequently have experienced.

Laſt ſpring two children, a boy and a girl, the former ten years old, the latter eight years old, were ſeized with fevers; the boy had an inflammation in his breaſt. In leſs than two hours they drank each about five quarts of warm tar water, which wrought them very differently, the girl

girl as an emetic, the boy as a gentle purge, but both alike immediately recovered, without the uſe of any other medicine: of this I was an eye-witneſs, and I have found by frequent experience, that the beſt way is, to let this medicine take its own courſe, not hindered nor interrupted by any other medicines; and this being obſerved, I never knew it to fail ſo much as once, in above a hundred trials in all ſorts of fevers.

Nevertheleſs there are not wanting thoſe who would inſinuate, that tar water made in the common way contains noxious oils or particles of tar, which render it dangerous to thoſe who drink it, a thing contrary to all my experience. This was the old objection made by thoſe who oppoſed it from the beginning. But I am convinced by innumerable trials, that tar water is ſo far from doing hurt by any cauſtic or fiery quality, that it is on the contrary a moſt potent medicine for the allaying of heat, and curing of all inflammatory diſtempers. The perpetual returning to the ſame objection makes it neceſſary to repeat the ſame anſwer.

And yet, ſome who are not afraid to argue againſt experience, would ſtill perſuade us that the common tar water is a dangerous medicine, and that the acid freed from the volatile oil is much more ſafe and efficacious: but I am of opinion, that being robbed of its fine volatile oil (which neither ſinks to the bottom nor floats at the top, but is throughout and intimately united with it, and appears to the eye only in the colour of tar water); being robbed, I ſay, of this oil, it is my opinion it can be no cordial, which opinion (not to mention the reaſon of the thing) I ground on my own experience, having obſerved that the moſt acid water is the leaſt cordial, ſo far am I from imputing the whole virtue to the acid, as ſome ſeem to think.

It ſeems not very reaſonable to ſuppoſe, that the cauſtic quality of tar water (if ſuch there was) ſhould be removed or leſſened by diſtillation,

or that a ſtill ſhould furniſh a cooler and better medicine than that which is commonly prepared by the ſimple affuſion and ſtirring of cold water. However the ends of chymiſts or diſtillers may be ſerved thereby, yet it by no means ſeemeth calculated for the benefit of mankind in general, to attempt to make people ſuſpect, and frighten them from the uſe of a medicine, ſo eaſily and ſo readily made, and every where at hand, of ſuch approved and known ſafety, and at the ſame time recommended by cures the moſt extraordinary, on perſons of all ſexes and ages, in ſuch variety of diſtempers, and in ſo many diſtant parts of chriſtendom.

By moſt men, I believe, it will be judged, at beſt, a needleſs undertaking, inſtead of an eaſy tried medicine to introduce one more operoſe and expenſive, unſupported by experiments, and recommended by wrong ſuppoſitions, that all the virtue is in the acid, and that the tar water being impregnated with volatile oil is cauſtic, which are both notorious miſtakes.

Though it be the character of reſin not to diſſolve and mix with water as ſalts do, yet theſe attracts ſome fine particles of eſſential oil, which ſerves as a vehicle for ſuch acid ſalts; and the colour of the tar water ſheweth the fine oil, in which the vegetable ſalts are lodged, to be diſſolved and mixed therein. The combination of two ſuch different ſubſtances as oil and ſalt, conſtitutes a very ſubtile and active medicine, fitted to mix with all humours, and reſolve all obſtructions, and which may properly be called an acid ſoap.

Tar water operates more gently and ſafely, as the acid ſalts are ſheathed in oil, and thereby loſing their acrimony, approach the nature of neutral ſalts, and ſo become more friendly to the animal ſyſtem. By the help of a ſmooth inſinuating oil, theſe acid ſalts are more eaſily and ſafely

ſafely introduced into the fine capillaries. I may add, that the craſis of the blood is perfected by tar water, being good againſt too great a ſolution and fluidity as a balſam, and againſt viſcidity as a ſoap, all which entirely depends upon the mixture of oil with the acid, without which it could neither operate as a balſam nor a ſoap; briefly, it was not mere acid or diſtilled water, or tincture of tar, but tar water, as commonly made, by affuſion and ſtirring of cold water upon tar, which hath wrought all thoſe great cures and ſalutary effects, which have recommended it as a medicine, to the general eſteem of the world.

The mixture of volatile oil, which is or contains the ſpirit, is ſo far from noxious, that it is the very thing that makes tar water a cordial; this gives it a grateful warmth, and raiſeth the ſpirits of the hyſteric and hypochondriacal; this alſo rendering the blood balſamic, diſpoſeth wounds of all ſorts to an eaſy cure; this alſo it is that fortifies the vitals, and invigorates nature, driving the gout to the extremities, and ſhortening the fits, till it entirely ſubdues that obſtinate and cruel enemy, as it hath been often known to do; but acid alone is ſo far from being able to do this, that on the contrary the free uſe of acids is reckoned amongſt the cauſes of the gout.

I never could find that the volatile oil drawn from tar by the affuſion of cold water produced any inflammation, or was otherwiſe hurtful, not even though the water by longer ſtirring had imbibed far more of the oil than in the common manner, having been aſſured, that ſome of ſtrong ſtomachs have drank it after twenty minutes ſtirring, without any the leaſt harm, and with very great benefit.

It hath been indeed inſinuated, that the oil was ordered to be ſkimmed off, becauſe it is cauſtic and dangerous; but this is a miſtake. I myſelf, among many others, drank the tar water for two years together, with its

its oil upon it, which never proved hurtful, otherwiſe than as being ſomewhat groſs, and floating on the top, it rendered the water leſs palatable, for which reaſon alone it was ordered to be ſkimmed.

It hath alſo been hinted, that making tar water the ſecond time of the ſame tar was cautioned againſt, for that it was apprehended ſuch water would prove too heating; which is ſo far from being true, that when I could not get freſh tar, I uſed the ſecond water without difficulty, by means whereof it pleaſed God to recover from the ſmall-pox two children in my own family, who drank it very copiouſly, a ſufficient proof that it is not of that fiery cauſtic nature which ſome would perſuade us.

The truth is, my ſole reaſon for adviſing the tar not to be uſed a ſecond time, was becauſe I did not think it would ſufficiently impregnate the water, or render it ſtrong enough after ſo much of the fine volatile parts had been carried off by the former infuſion. Truth obligeth me to affirm, that there is no danger (for as much as I could ever obſerve) to be apprehended from tar water; as commonly made; the fine volatile oil, on which I take its cordial quality to depend, is, in its own nature, ſo ſoft and gentle, and ſo tempered by the acid, and both ſo blended and diluted with ſo great a quantity of water, as to make a compound, cheriſhing and cordial, producing a genial kindly warmth without any inflaming heat, a thing I have often ſaid, and ſtill find it neceſſary to inculcate.

Some medicines indeed are ſo violent, that the leaſt exceſs is dangerous; theſe require an exactneſs in the doſe, where a ſmall error may produce a great miſchief. But tar is, in truth, no ſuch dangerous medicine, not even in ſubſtance, as I have more than once known it taken innocently, mixed with honey, for a ſpeedy cure of a cold.

But

But notwithſtanding all that hath been ſaid on that ſubject, it is ſtill ſometimes aſked what preciſe quantity or degree of ſtrength is required? to which I anſwer, (agreeably to what hath been formerly and frequently obſerved) the palate, the ſtomach, the particular caſe and conſtitution of the patient, the very climate or ſeaſon of the year, will diſpoſe and require him to drink more or leſs in quantity, ſtronger or weaker in degree; preciſely to meaſure its ſtrength by a ſcrupulous exactneſs, is by no means neceſſary. Every one may ſettle that matter for himſelf, with the ſame ſafety that malt is proportioned to water in making beer, and by the ſame rule, to wit, the palate.

Only in general thus much may be ſaid, that the proportions I formerly recommended will be found agreeable to moſt ſtomachs, and withal of ſufficient ſtrength, as many thouſands have found, and daily find, by experience. I take this opportunity to obſerve, that I uſe tar water made in ſtone-ware or earthen very well glazed, earthen veſſels unglazed being apt to communicate a nauſeous ſweetneſs to the water.

Tar water is a diet-drink, in the making whereof there is great latitude, its perfection not conſiſting in a point, but varying with the conſtitution and palate of the patient, being nevertheleſs, at times, taken by the ſame perſon, weaker or ſtronger, with much the ſame effect, provided it be proportionably in greater or leſſer quantity. It may indeed be ſo very weak as to have little or no effect; and, on the other hand, ſo very ſtrong, as to offend the ſtomach; but its degree of ſtrength is eaſily diſcerned by the colour, ſmell, and taſte, which alone are the natural and proper guides whereby to judge thereof; which ſtrength may be eaſily varied, in any proportion, by changing the quantity either of tar or water, or the time of ſtirring. As for ſetting tar water to ſtand, this is not to make it ſtronger, but more clear and palatable.

I found:

I found myſelf obliged to aſſert the innocence and ſafety, as well as uſefulneſs of the tar water, as it is commonly made by the methods laid down in my former writings on this ſubject; and this not only in regard to truth, but much more in charity to a multitude, which may otherwiſe perhaps be influenced by the authority of ſome, who endeavoured to put them out of conceit with a medicine ſo cheap, ſo efficacious, and ſo univerſal, by ſuggeſting and propagating ſcruples about a cauſtic quality ariſing from the volatile oily particles of tar, or reſin imbibed together with the acid in making tar water; an apprehenſion ſo vain, that the reverſe thereof is true, for which I appeal to the experience of many thouſands, who can anſwer for the innocence and ſafety, as well as efficacy, of this medicine, of which there are ſuch ample and numerous certificates publiſhed to the world.

I ſhall finiſh my eſſay on the plague and its cure, with obſerving, that in caſe God ſhould with-hold his hand for the preſent, yet theſe reflections will not be altogether fruitleſs, if they diſpoſe men to a proper temper of mind, and a cautious regimen, avoiding all extremes, (which things are juſtly reckoned among the chief preſervatives againſt infection) but eſpecially if the apprehenſion of this deſtroyer ſhall beget ſerious thoughts on the frailty of human life, and, in conſequence thereof, a reformation of manners; advantages that would ſufficiently repay the trouble of writing and reading this letter, even though the trial of tar water, as a remedy for the plague, ſhould be poſtponed (as God grant it may) to ſome future and diſtant opportunity.

cannot bear it. But when it takes a turn towards working upwards, nature, by that very way, hath been often known to carry on the cure. A worthy gentleman, member of parliament, came into my neighbourhood, in the autumn of the year 1750; he was cachectic and extremely reduced, ſo that his friends thought him near his end. Upon his entering into a courſe of tar water, it produced a prodigious vomiting, which weakened him much for the preſent; but perſiſting to continue the uſe thereof for about two months, he was reſtored to his health, ſtrength, and ſpirits.

Tar water is very diuretic, thereby preventing ſtone and gravel, and carrying off by urine, thoſe ſalts that might otherwiſe occaſion fevers, rheumatiſms, dropſies, head-achs, and many other diſorders, if retained in the blood. Hence, ſome have apprehended a diabetes, from the continued uſe thereof, but it is ſo far from cauſing a diabetes, that it hath been known to cure that diſorder.

The conſtitution of a patient ſometimes requireth during a courſe of tar water, that he take water and honey, alſo roaſted apples, ſtewed prunes, and other diet of an opening kind. A hint of this is ſufficient. If the reader now and then meets with ſome remarks, contained in my former writings on this ſubject, he may be pleaſed to conſider, I had rather repeat than forget what I think uſeful to be known.

Some, endeavouring to diſcourage the uſe of tar water in *England*, have given out that it may indeed be ſerviceable in *Ireland*, where people live on ſuch low diet as ſour milk and potatoes, but it cannot be of the ſame ſervice in *England*, where men are accuſtomed to a more liberal and hearty food; and indeed it muſt be owned, that the peaſants in this iſland live but poorly, but no people in *Europe* live better (in the ſenſe of

eating and drinking) than our gentry and citizens; and from theſe the inſtances of cures by tar water have been chiefly taken. Thoſe who would confine its uſe to the moiſt air and poor diet of *Ireland*, may be aſſured that all over *Europe*, in *France*, and *Germany*, *Italy*, *Portugal* and *Holland*, tar water works the ſame effects. In both *North* and *South*, in *Weſt* and *Eaſt Indies*, it hath been uſed and continues to be uſed with great ſucceſs. It hath reached all our colonies both on the continent and the iſlands, and many barrels of tar water have been ſent from *Amſterdam* to *Batavia*; of all which I have had authentic accounts. But its uſe is no where more conſpicuous than at ſea, in curing that plague of ſeafaring perſons, the ſcurvy, as was found in the late attempt to diſcover a north-weſt paſſage; and (as I doubt not) will be found as oft as it is tried. Every ſhip in his majeſty's navy ſhould always have a veſſel of tar water upon deck, for the uſe of the ſailors, both in the ſcurvy and other maladies.

It is indeed a medicine equally calculated for all climates, for ſea and land, for rich and poor, high and low livers; being, as hath been elſe where mentioned, a cordial which doth not heat; a peculiar privilege this, and of excellent uſe. That it is a cordial, is manifeſt from its cheering and enlivening quality, and that it is not heating, is as manifeſt, from its ſingular uſe in all caſes where the blood is inflamed. As this medicine imparts a genial friendly warmth, ſuited to the human conſtitution, thoſe who paſs through a courſe of tar water, would do well not to increaſe ſuch friendly warmth to an inflaming heat, by a wrong regimen of high ſeaſoned food and ſtrong liquors, which are not wanted by the drinkers of tar water. There is a certain degree of heat neceſſary to the well-being and life of man. More than this will be uneaſy, and this uneaſineſs indicates a proper choice of dict.

I have

I have myſelf drank above a gallon of tar water in a few hours, and been cooled and recovered from a fever by it. So many inſtances of the ſame nature I have known, as would make it evident to any unprejudiced perſon, that tar water is a cooling medicine; of which truth I am as thoroughly convinced, as it is poſſible to be of any theorem in phyſic or natural ſcience.

The unſucceſsfulneſs of other methods, ſhould rather be an encouragement than a bar to the trial of tar water. A young lady, daughter to a worthy gentleman near *Cork*, had been long afflicted with a grievous pain in her ſide, and having had the beſt advice that could be got, was not relieved until ſhe drank tar water, which quite removed her pain. Some time after ſhe was again ſeized with the ſame diſorder, but returning to the uſe of tar water, ſhe grew well, and ſtill continues ſo.

A woman turned out of the infirmary at *Cork*, as incurable, becauſe ſhe would not ſubmit to the cutting off her leg, came to *Cloyne*, where ſhe continued half a year drinking tar water, and living upon bread and milk, by which courſe ſhe recovered, and went to ſervice.

There is at preſent, while I am writing, a moſt remarkable caſe here at *Cloyne*, of a poor ſoldier in a dropſy, whoſe belly was ſwoln to a moſt immoderate ſize. He ſaid he had been five months in an hoſpital at *Dublin*, and having tried other methods in vain, left it to avoid being tapped. It is a fortnight ſince he came to *Cloyne*, during which time he hath drank two quarts of tar water every day. His belly is now quite reduced: his appetite and ſleep which were gone are reſtored: he gathers ſtrength every moment: and he who was deſpaired of ſeems to be quite out of danger, both to himſelf, and to all who ſee him. It is remarkable, that upon drinking the tar water, he voided ſeveral worms of a very

extraordinary ſize. This medicine, which is obſerved to make ſome perſons coſtive, is to hydropic patients a ſtrong purge. The preſent is but one of ſeveral inſtances, wherein the dropſy hath been cured by tar water; which I never knew to fail in any ſpecies of that malady.

I am very credibly informed, that an aged clergyman of *Maidſtone* in *Kent*, being reduced to the laſt extremity by the gout in his ſtomach, after having tried ſtrong liquors, and the methods uſual in that caſe without ſucceſs, betook himſelf to drink a vaſt quantity of warm tar water, ſtill repleniſhing and letting it take its courſe; by which it pleaſed God to deliver him from the jaws of death.

A gentleman in the county of *Clare*, near *Ennis*, had a fever and pleuriſy, and inflammation of the lungs, being at the laſt extremity, and given over by two phyſicians, he was adviſed to drink tar water, which he did, eight quarts. Next morning one of the doctors aſking at what hour his patient died? to his great ſurpriſe found he was recovered. This I had from a parliament-man his neighbour.

When the yellow fever (as it was called) raged in the *Weſt Indies*, the negroes, with a tub of tar water in their quarters, did well: but ſome of the better ſort miſcarried, among whom the phyſician himſelf lay at the point of death; but his brother recovered him by pouring down his throat in ſpoonfuls, ſome of the ſame liquor that recovered the negroes. The fact was related to me by a gentleman who was then in the iſland of St. *Chriſtopher*'s, and knew it to be true.

A phyſician himſelf, not long ſince aſſured me, he had cured an ulcer in the bladder, by ordering his patient to drink tar water, when

when he had tried all other methods in vain, and thought the caſe incurable.

But it would be endleſs to relate the effects of tar water, in deſperate caſes. The recovery of Mrs. *Wilſon*, daughter to the late biſhop of *London*, from a lingering hopeleſs diſorder, was a noted caſe, and atteſted to by his lordſhip. I have even been informed upon good authority, of two or three inſtances, wherein perſons have been recovered by tar water, after they had rattles in the throat.

In certain caſes, a ſmaller quantity of tar water hath proved ineffectual, when a larger hath perfected the cure. A woman of *Cloyne* got cold after child-bearing, which occaſioned a great pain in her thigh, ſwelling alſo and redneſs; ſhe continued in great torment above three weeks. She then began to drink tar water, but not drinking much ſhe did not perceive much good; and when there was not any hopes of her life, ſhe was perſuaded to try what a gallon a day might do, upon this ſhe grew better, the ſwelling broke and ran; no dreſſing was uſed but tar, and no waſhing but tar water, until ſhe was quite recovered.

In ailments of an odd and untried nature, it may be worth while to try tar water. In proof of this many inſtances might be given. A gentleman with a withered arm had it reſtored by drinking tar water. Another who, by running his head againſt a poſt, had a concuſſion of the brain attended with very bad ſymptoms, recovered by drinking tar water after other medicines had failed. In my own neighbourhood, one had loſt the uſe of his limbs by poiſon, another had been bitten by a mad aſs; theſe perſons drank tar water, and their cure was attributed to it.

When

When tar water is copiouſly drank in fevers, the great danger to be guarded againſt, is an exceſſive flow of ſpirits, which excites the patient to talk and divert himſelf with company, which may produce a relapſe; of this I have known fatal effects.

If in a courſe of tar water, the patient ſhould find himſelf heated, let him abſtain from or leſſen his doſe of ſpirituous and fermented liquors; for tar water alone never heats.

In chronical diſorders it is not adviſeable, to break off a courſe of tar water at once, but rather to diminiſh the quantity by degrees.

The acid alone hath not the medicinal virtues of tar water. This is agreeable to reaſon and experience, as well as the opinion of the ableſt judges. Doctor *Linden* juſtly obſerves, "that when the empyreumatic "oil is entirely ſeparated from the acid, it is not in any ſhape ſuperior "to any other diſtilled acids or vinegars whatſoever." *Treatiſe on Selter Water*, p. 307.

* That extraordinary virtues ſhould be contained in tar water, will not ſeem ſtrange, if we conſider that pitch is nothing elſe but hardened tar,

* Something of this nature hath been long expected, and hoped for, if we may credit that learned chymiſt Doctor *Linden*, "at laſt (ſaith he) the long delayed wiſhes of the "moſt eminent men of the faculty are fulfilled, in the Biſhop of *Cloyne*'s diſcovery." See *Treatiſe on Selter Water*, p. 303. Again (ſpeaking of empyreumatic oils of plants) he hath theſe words, "There has always prevailed a notion among the chymiſts, and "particularly with *Paracelſus* and his followers, that in thoſe oils there lay a great ſe-"cret undiſcovered. This notion was occaſioned by the ſtrange effects which a ſmall "quantity thereof hath upon the human machine. Several have been very diligent to "diſcover

tar, or tar drained of its moiſture; and that an extraordinary quantity of light is retained in the ſubſtance of pitch, as appears from certain electrical experiments, which, having been made ſince, ſeem not a little to confirm what had before been ſuggeſted in *Siris*.

" diſcover this ſecret, and to find out a method to adminiſter theſe oils with ſafety; yet " nothing was performed ſalutary, until the Biſhop of *Cloyne* diſcovered to us the tar " water, to him alone we are indebted, for rendering the empyreumatic oils a ſafe me- " dicine, in every reſpect." *Ibid.* p. 302.

F I N I S.